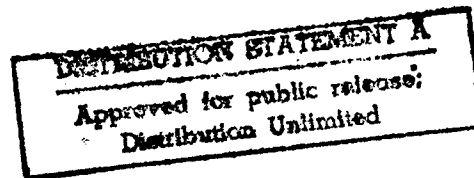


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# China Report

ECONOMIC AFFAIRS

ENERGY: STATUS AND DEVELOPMENT -- 35

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29 January 1985

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## NATIONAL POLICY

### SHARP INCREASES IN ENERGY OUTPUT FORECAST FOR 1985

Beijing JINGJI RIBAO in Chinese 7 Jan 85 p 2

/Article by JINGJI RIBAO reporter Ding Shi (0002 1102) in "Economic Prospects" column: "Energy Production Will Increase Enormously This Year"

/Text In 1984, the energy production situation was better than in any previous year. During the past year, our country's output of coal, electricity, and oil all set new records. The actual coal output was over 760 million metric tons, an increase of 7.7 percent over that in 1983; that of oil reached over 114 million metric tons, an increase of 8.2 percent; and that of electricity reached over 370 billion kilowatt-hours, an increase of 7 percent. The all-round increase in energy production provided an important guarantee for the continuous growth in the national economy at a relatively quick pace.

Will there be a further sharp increase in energy production? What are the prospects for energy production? The information supplied by relative departments shows that in 1985, the energy production of the whole country will continue to develop at a relatively fast pace. However, the percentage increase in energy output will be lower than that of the GNP. The new projects which will go into operation next year, the development of town and township industries, and the improvement in people's living standards will all increase the demands for energy. This and plus our limited transport capacity make it impossible to alleviate the shortage of energy supply, in particular, electricity supply.

According to the plans of the relevant departments, in 1985 the output of coal will be 790 million metric tons, of which 336 million will be produced by local coal mines and 404 million will be produced by the coal mines whose coal is allocated by the state in a centralized manner. Authoritative people are of the opinion that this year the latter coal mines will be assigned by contracts the overall responsibility for input and output; therefore, they will certainly achieve the goal of increasing coal output by 20 million metric tons, and it should be possible to exceed this goal by 5 million metric tons. The output of local coal mines will increase relatively sharply. Therefore, it is possible for the coal output of the whole nation to exceed 800 million metric tons. However, the continuous shortage of coal transport facilities will impede the transport of coal from the coal production areas to eastern areas that lack coal.

In 1985, the oil production will climb to a new height and the output of petroleum will reach 124 million metric tons, an increase of 10 million metric tons or 7 percent over last year. The output of natural gas will reach 12.5 billion cubic meters, and the discovery of new geological petroleum deposits will rise comparatively sharply compared with 500 million metric tons discovered in 1983. This year we will also transform seven existing petroleum pipelines, including the Daqing-Tieling and Dongying-Huangdao pipelines and build 11 new pipelines, and thus increase oil transport capacity by tens of millions.

The relevant departments are of the opinion that the situation in the power industry will be grim in 1985. The annual output of electricity is planned to be 396 billion kilowatt-hours, an increase of 20 billion kilowatt-hours over 1984. The increase in electricity output will mainly rely on the additional capacity of newly installed generators and the satisfactory water conditions for our hydraulic power stations. The capacity of the generators that were newly installed in 1984 is only 3.1 million kilowatts and can only yield 16 billion kilowatt-hours of electricity. The water situation for 1985 is as yet unpredictable; therefore, there may be some shortages and we may not be able to avoid the practice of limiting the consumption of electricity. Out power departments are adopting many measures and striving to produce more electricity safely and steadily and raise power production to a higher level.

The key factors in assuring a relatively vigorous development of energy production in 1985 are: 1) We should conscientiously implement the state's principles and policies related to reforms, such as the method of assigning all-round responsibility for output by contracts in the petroleum and coal sectors. We should also continue to perfect and implement various forms of economic responsibility systems, give play to the initiative of the enterprises and their staff and workers, and strive to increase production to a greater extent. 2) We should give play to the initiative of all sectors and thus increase energy output. Our coal sector should vigorously develop small coal mines and our electricity sector should enable local power stations and the power stations installed by enterprises on their own that are linked with power networks to increase power output. 3) All the sectors should coordinate with one another. In particular, the railway and communications and transport sectors should closely coordinate with each other. The departments concerned also hope that the various areas, departments, and enterprises should continue to make efforts to increase production and the speed of transportation. They should systematically grasp the work of energy conservation, reduce the pressure due to the shortage of energy supply, and actually achieve the goal of simultaneously grasping energy conservation and the development of energy production.

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CSO: 4013/78-F

## NATIONAL POLICY

### NEW DEVELOPMENTS IN ENERGY INDUSTRY HIGHLIGHTED

HK290218 Beijing ZHONGGUO XINWEN SHE in Chinese 0218 GMT 26 Dec 84

[Report by Li Jian [2621 0256]: "China's Energy Industry Enters a New Period of Development"]

[Text] Beijing, 26 Dec (ZHONGGUO XINWEN SHE)---A new situation of quick, balanced, and all-round growth has emerged in the development of China's energy industry this year. Chinese leaders said that China's energy industry did better this year than in any previous year and that its energy industry had entered a new period of development.

In regard to the coal industry, which yields 70 percent of China's energy, despite the serious losses caused by rare flooding in the mines in Kailuan and Fangezhuang, this year this industrial sector had fulfilled ahead of schedule the nation's coal production goal by 10 December. It is expected that the output of coal for the year will total 760 million metric tons, surpassing the Soviet Union and ranking second only to the United States.

The petroleum industry is an important base in China's national economy. By 13 December, the output of petroleum totaled 108.79 million metric tons, and it is estimated that the output for the whole year will amount to over 114 million metric tons, over 8 million metric tons more than last year, which will be a new record.

In regard to China's electric power industry, the hydroelectric power output has decreased by 500 million kilowatt-hours because water conditions are not as good as last year. However, the output of thermal power has increased. The goal for the output of the final year of the Sixth Five-Year Plan was fulfilled on 21 December, 1 year and 10 days ahead of schedule. It is expected that the power output for the whole year will total 373.6 billion kilowatt-hours.

One of the important reasons for the steady increase in China's energy industry is the increase in investment. This year the state's investment in the energy and communications industries has accounted for nearly 40 percent of the nation's total investment in capital construction. Among the 123 key construction projects in the country, 46 are energy projects, of which 14 are industrial coal projects, 26 are industrial power projects and 6 are petroleum

projects. Senior Chinese leaders have paid frequent visits to oilfields, coal mines, and power stations this year, thus showing special concern for the power industry.

With the upsurge of the nationwide economic structural reform, China's energy industry departments have vied with one another in formulating reform plans, adopting new measures, and encouraging the development of production. The Ministry of Coal Industry has implemented the principle of "state, collectives, and individuals developing the coal industry together, and large, medium and small coal mines developing at the same time." By so doing, it has not only caused the output of coal produced by the coal mines under the unified control of the state to increase for 3 years in succession, but has also resulted in local mines developing prosperously. According to our statistics, there are over 50,000 collective and individual coal mines throughout the country, of which over 13,000 are coal mines exploited by individuals in the areas to the south of the Chang Jiang. It is estimated that the output of local coal mines will reach 366 million metric tons this year, an increase of over 16 percent over last year and the sharpest increase in the past 30-odd years.

Since the policy of assigning by contracts the all-round responsibility for petroleum output totalling 100 million metric tons in our petroleum industry, we have vigorously strengthened prospecting work and put an end to the previous situation of petroleum exploitation developing faster than prospecting. Over 500 million metric tons of oil deposits were discovered last year, and 550 square meters of oil-bearing land and 700 million metric tons of oil deposits have been discovered this year. A number of high-yield wells have been sunk in Shengli, Liaohe, Dagang and other oilfields. In the Shengli oilfield alone, 11 high-yield oil wells of over a 1,000-ton production capacity have been sunk this year, which is equal to the number of higher-yield oil wells that were sunk over more than 20 years in the past. The highest yield well delivers 3,635 metric tons of oil a day. Major progress has been achieved in the oil and gas prospecting work in the Songhua Jiang-Liao He Basin, Henan, Hubei, Jiangsu, Nei Monggol's Erlian Basin, Bo Hai Bay Basin, Xinjiang's Tarim Basin and Junggar Basin, and the Shaanxi-Gansu-Ningxia area.

Conscientiously cooperating with foreign businessmen in exploiting coal, oil and other resources is a long-term policy for China's energy industry.

Chinese and foreign cooperation in exploiting offshore oil is already in full swing. To date, China has signed 23 contracts with 31 companies from 10 countries on the prospecting and exploitation of offshore oil resources. The Chengbei oilfield on the Bo Hai and the Beibuwan oilfield in the South China Sea are expected to produce oil next year or the year after. The second round of bidding for offshore oil cooperation projects began on 22 November. At present, 40 foreign oil companies have acquired data about the areas in the Yingge Sea for which bids are sought. As China is doing in exploiting offshore oil, it is also probing ways to use advanced foreign technology in discovering and exploiting new oilfields on its land.

In the field of exploiting coal, in addition to establishing scientific and technological exchange and cooperation relations with the United States, Britain, Japan, the FRG, Belgium, and France, this year China has carried out scientific and technological exchanges and cooperation with the Soviet Union, Eastern Europe, and Third World countries. There were 54 joint effort projects, and the 460 manhours of contacts have been carried out. At present, the total volume of the cooperation projects related to coal that China is discussing with foreign businessmen is about 100 million metric tons. This year it has signed over \$68 million worth of contracts with foreign businessmen on importing equipment and technology.

In the field of developing nuclear power stations, China will intensify its cooperations with foreign countries. Major prospective cooperation partners include France, the United States, Japan, Britain, and the FRG.

CSO: 4013/70

## NATIONAL POLICY

### CHINA'S CURRENT ENERGY SITUATION, FUTURE TASKS OUTLINED

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese No 5, 25 Oct 84 pp 1-4

[Article by Zhang Zhijian [1728 0037 1017], Wang Jiacheng [3769 1367 1004], Xin Dingguo [6580 1353 0948]: "China Has Bright Energy Future, But the Tasks Ahead Are Arduous"]

[Text] [1] China's present economic situation is good. So is its energy situation, as indicated by, first, the steady growth in energy output, now at its highest level ever; second, the bright prospects of energy resource development; and third, the remarkable results and vast potential of energy conservation.

Statistics show that in 1983 China produced 715 million tons of raw coal, 106.07 million tons of crude oil, 12.21 billion cubic meters of natural gas, and 86.4 billion kilowatt-hours of hydropower output, all fulfilling the 1985 targets of the "Sixth Five-Year Plan" ahead of time. Primary energy output has already risen above 700 million tons of standard coal (713 million tons, to be exact), improving the 1982 figure by 45 million tons, or 6.7 percent.

Also in 1983, total agricultural and industrial output value reached approximately 904.4 billion yuan (in 1980 comparable prices,) which met the target set for 1985 by the "Sixth Five-Year Plan" 2 years earlier than projected (871 billion yuan). The "Sixth Five-Year Plan" calls for an average annual growth rate of 4 percent. In fact, between 1981 and 1983, the economy was advancing at an average annual rate of at least 8 percent.

Table 1 contains statistics on China's primary energy production and total agricultural and industrial output value in recent years.

Energy has played a significant role in ensuring economic growth in the past few years. Because of continuing efforts to readjust the industrial structure, the product mix and enterprise organizations, and strengthen the scientific management of energy consumption and popularize new conservation technologies, we have managed to save at least 20 million tons of standard coal each year. Table 2 provides a statistical summary of China's energy consumption and conservation in recent years.

Energy consumption per unit of agricultural and industrial output value has decreased by 4.98 percent for each of the past several years. In 1983, every 100 million yuan of industrial output consumed about 70,000 tons of energy,

Table 1. China's Primary Energy Output and Total Agricultural and Industrial Output Value in Recent Years

Category	1978	1979	1980	1981	1982	1983
Primary Energy Output						
raw coal (million tons)	617.86	635.54	620.15	621.63	666.33	715.00
crude oil (million tons)	104.05	106.15	105.95	101.22	102.12	106.07
natural gas (billion cubic meters)	13.75	14.51	14.27	12.74	11.93	12.21
hydropower (billion kw)	44.60	50.10	58.20	65.50	74.40	86.40
Total energy output (million ton standard coal)	628.00	646.00	637.00	632.00	668.00	713.00
Total agriculture and industrial output value (1970 comparable prices; billion yuan)	569.00	617.50	661.90	691.90 (749) <sup>a</sup>	820.70	(904.4) <sup>b</sup>
Total industrial output value (1970 comparable prices; billion yuan)	423.10	459.10	499.20	519.90 (517.80)	(557.8)	(616.6)
light industries	180.60	198.00	234.40	267.50 (266.30)	(281.5)	(306.0)
heavy industries	242.50	261.10	264.80	252.40 (251.50)	(276.3)	(310.6)

Notes: a. Figure in parentheses calculated according to 1980 comparable prices.

b. Calculated in 1983 prices, total agricultural and industrial output value was 920.9 billion yuan, total industrial output, 608.8 billion yuan, of which light industries accounted for 295.4 billion yuan and heavy industries, 313.4 billion yuan.

Table 2. China's Energy Consumption and Conservation in Recent Years

Category	1978	1979	1980	1981	1982	1983
Energy consumption (million tons of standard coal)	571.44	585.88	602.75	594.47	619.37	-
Industrial and Agriculture Output Value (1970 com- parable prices, million yuan)	569.00	617.50	661.90	691.90 (749)	(820.70)	(904.4)
Energy consumption per 100 million yuan of industry and agri- culture output value (10,000 tons of standard coal)	10.04	9.49	9.11	8.59 (7.94)	(7.55)	-
Actual Energy Saved (million tons of standard coal)	-	23.60	35.00	24.00	20.00	Industrial enterprises 18.00

Note: Figures in parentheses calculated according to 1980 comparable prices.

down from 81,800 tons in 1980. Meanwhile, the unit energy consumption in certain major commodity industries has also been dropping steadily. For example, it took only 404 grams of standard coal to produce one kilowatt-hour of thermal power in 1982, compared to 434 grams in 1978. The aggregate energy consumption of a ton of steel was 1.87 tons of standard coal in 1982, down from 2.87 tons in 1977. Similarly, small chemical fertilizer enterprises nation-wide required 17.9 million kilocalories of aggregate energy to make one ton of synthetic ammonia in 1983, compared to 28.17 million kilocalories in 1978.

[2] China's energy production can look forward to a bright future. It is estimated that by the end of the century, total energy output will reach 1.2 billion tons of standard coal, doubling that of 1980. But energy demands will also rise substantially as the four modernizations proceed. If we want to see continuous improvement in economic results and quadruple the nation's total agricultural and industrial output value by the year 2000, as put forward by the Twelfth Party Congress, both energy development and energy conservation promise to be difficult tasks.

Now that energy development has been made a focus in China's modernizing construction, human and financial resources are being pooled together to carry

out a large number of energy projects. The state is scheduled to invest a total of 54.1 billion yuan in the energy industries during the "Sixth Five-Year Plan" period.

In the near future, coal will remain our primary energy resource. There will be a net increase of 80 million tons in coal production from 1980 through 1982. Estimated raw coal output for 1985, 1990 and 2000 are 750 million tons, 850-900 million tons and 1.2 billion tons respectively. To ensure a steady expansion in raw coal production, we must henceforth concentrate resources on and strive for the success of the following tasks:

1. The technical transformation of existing mines. There are currently 82 mining bureaus and over 500 mines throughout the country. Of these 500 mines, which are directly managed by the Ministry of Coal Industry, some are old mines producing 70 million tons of coal each year and due for abandonment by the year 2000. To reduce the impact of abandonment on coal production, we must technically transform other existing mines, improve their productive conditions and upgrade their labor productivity so that production is stabilized and increased; costs, reduced and economic results, improved.
2. The planned and systematic development of new mines, including the construction of an energy-producing center based in Shanxi Province and the development of large-scale open-pit coal mines in eastern Nei Mongol. With more than 60 percent of the nation's known coal reserves, the Shanxi energy center (including all of Shanxi, northern Shaanxi, western Henan and western Nei Mongol), will be the linchpin in energy construction during the periods covered by the "Sixth Five-Year Plan," the "Seventh Five-Year Plan," and all the way to the year 2000. According to the construction plan of the center, it will produce 600 million tons of coal in 2000, of which 360 million tons will be exported to other parts of the country. Also in the works is a coal-fired electric installed capacity of 46 million kilowatts, which will provide northern China and other areas with 50 billion kilowatt-hours of electricity each year. In addition to satisfying its own needs. In this way it will become China's largest energy-based heavy chemical industrial center.
3. The simultaneous development of small, medium and large coal industries and the vigorous promotion of small and medium-sized coal mines. Local mines are operated by individual provinces, municipalities, autonomous regions, cities and counties. Such mines now total 18,000 nation-wide and produce 337 million tons of raw coal each year, of which 182 million tons are produced by state-operated local mines, the rest by mines run by small townships (155 million tons). By making possible the consumption of coal right where it is mined, local mines contribute extensively to local economic development. Consequently, the technical transformation of existing mines should include small and medium-sized local mines. Their projected raw coal output is 400 million tons by the end of the century.
4. The further development of coal washing, processing and multi-purpose utilization to increase utilization ratios. At the moment, we have a limited coal washing capacity of slightly over 100 million tons, which is only 19 percent of raw coal output. While most of the coking coal used in the metallurgical industry is washed, little of the anthracite and coking coal used in the synthetic ammonia industry is thus treated. And coal burned to generate electricity, as a rule,

is not washed at all. Low washing rates adversely affect utilization ratios. From now on, systematic steps must be taken to develop coal washing so that by the year 2000, about 40 percent of our coal will be thus processed.

In developing the electric industry, we must make full use of favorable conditions and concentrate on the construction of a number of hydropower stations and thermal power stations. Where conditions are advantageous, we should also build a cluster of small and medium-sized hydropower stations so as to expand the hydropower component of China's energy mix. Where energy is in short supply, we should consider building nuclear power stations. In addition, we must speed up the construction of extra-high tension power lines to broaden the areas served by electric power networks.

In 1983, China's total electric generating capacity reached 351.4 billion kilowatt-hours, an increase of 50.8 billion kilowatt-hours over 1980. During those 3 years, the annual growth rate was 5.3 percent. Estimates for 1985, 1990 and 2000 are 375-380 billion kilowatt-hours, 520 billion kilowatt-hours and 1-1.2 trillion kilowatt-hours respectively. The average annual growth rate in electric generating capacity for the next 17 years is 6.4-7.5 percent.

Now and in the near future, the focus in hydropower development should be the construction of several hydropower centers in the richly endowed southwest, northwest and central-south China, with a combined possible capacity of over 45 million kilowatts. Included are 7 hydropower staircases on the upper reaches of the Huang He, with a designed generating capacity of 4-7 million kilowatts, and others along the Hongshui He, with a capacity of 5-6 million kilowatts, on the upper and middle reaches of the Chang Jiang, with a capacity of 16 million kilowatts, and on the middle and lower reaches of the Lancang Jiang, with a capacity of 2-4 million kilowatts.

The development of thermal power generation must be coordinated with the development of coal. Clusters of electric power stations should be built near coal pits in mining areas to form strong thermal power centers. Apart from the energy center in Shanxi, coal-producing centers along the Huolin He in the northeast, in Huaibei and Huainan in eastern China, southern Shandong, northwestern Ningxia and in Liupanshui in the southwest can all support large-scale electric generating stations with a capacity of between 2 to 10 million kilowatts of electricity.

It has been the common experience of industrialized nations in the world to use high-efficiency and high-capacity generating sets to develop a large-scale electric power system. China's thermal power industry must also gradually expand the existing electric power system rationally by using a host of energy resources. To begin with, we should combine the present 30 or more electric networks into 7 large interprovince networks, that is, north China, northeast, central China, east China, northwest, southwest and south China. Next, we should strengthen inter-network cooperation in order to achieve a national integrated electric power system as soon as possible. This means that we must continue to give high priority to the construction of 50,000-volt electric networks and actively master the technology of higher voltages and direct current electric transmission in order to lay the groundwork for future long-distance power transmission.

To speed up the discovery of more oil fields and more natural gas deposits, the future development of China's oil industry must focus on geological prospecting, in the continental shelf as well as on land. In developing oil fields, efforts must be made to improve oil extraction technology and consequently the oil recovery ratio. How we develop the oil industry has a major bearing on the four modernizations. For 6 successive years after 1978, China's annual crude oil output has been kept above the level of 100 million tons. In addition, there was a slight increase in production in 1983 over 1982. In the future, we must adopt a variety of measures to strengthen oil field management, tap production potentials and go all out to achieve an annual growth rate of 2-3 percent on the basis of our annual output of 100 million tons.

Energy conservation is China's long-term strategic task. It has been calculated that from production through processing and transformation, storage and transportation to end use, the effective energy utilization rate is 25.86 percent. Corresponding figures for Japan and Western Europe are 36.4 percent and 32 percent, respectively. The energy utilization rates in various departments and for individual pieces of equipment also fall short of those in advanced nations. Since gross waste continues to plague energy consumption in China, it follows that our conservation potential is also immense.

To economize on energy in the future, we must strengthen energy management and do a good job in the comprehensive utilization of resources. New enterprises must use energy-efficient technology and equipment, while existing enterprises should undergo systematic technical transformation to effect energy savings. In addition, the economic structure should be readjusted in a planned and systematic way, including the adoption of various measures and the setting of energy conservation goals so that our agricultural and industrial output value per unit of energy will double what it is now.

The scientific management of energy requires that we come to grips with energy statistical analysis and enterprise energy balance, perfect an energy testing and measuring system and set up and fine tune a mechanism to assess and monitor an enterprise's energy utilization. It also requires a system under which energy is allocated in accordance with quotas. Moreover, we must improve our economic management techniques and make good use of credit, tax revenue, pricing, and rewards and punishments to integrate closely energy and the managerial activities of industrial and mining enterprises.

In technically transforming existing enterprises to make them more energy-efficient, we should give priority to items that require little investment but produce good and quick results so that the direct energy utilization ratio can be increased as rapidly as possible. Given China's current scientific and technological standard, the following direct energy-saving measures might be taken: 1) centralize the supply of heat and create heat/power coproduction; 2) transform low and medium-voltage generators; 3) modernize industrial boilers, kilns, and general equipment; 4) transform small chemical fertilizer plants; 5) make use of residual heat; 6) make rational use of low-calorific value fuels; 7) develop urban coal gas and shaped coal; and 8) modify motor vehicles.

Besides direct energy-saving measures, indirect ones also deserve our attention, including the rational readjustment of the industrial structure, the rational distribution of productive forces, the conservation of raw materials and the improvement of product quality. We must keep in mind the interests of the entire society and consume energy in a more efficient way.

[3] The geographical distribution of China's verified energy resources is very uneven: coal is abundant in the north, but rare in the south; oil is concentrated in the northeast and eastern China, and exploitable hydropower resources are predominantly in the southeast. Because of the long distances separating resources from where they are consumed, we must find appropriate solutions to the long-haul transportation problems of energy. In 1980, China's energy freight volume amounted to 1 billion tons, about 42 percent of the total freight volume. In planning the construction of and investment in future energy-producing centers, we must take into account the need for suitable railroads, harbors, and power transmission. To properly reduce the energy freight volume over long distances, which would mean trimming transportation investments and expenditures, we should coordinate in all localities the development of the energy industries with that of energy-intensive industries and bring about a rational balance between energy supply and energy consumption. For example, in energy-short areas, a curb should be put on industries which are heavy energy users. Coal should be allocated rationally, inter-regional transfers should be reduced, the average distance of such transfers should be reduced, coal washing capacity must be increased, and unnecessary shipments must be cut back.

The characteristics of China's energy consumption are, first, the essential role played by coal, which over the years has made up more than 70 percent of all energy consumed, and second, the predominant share of energy that goes to industrial users, which account for about two-thirds of total energy consumption. These characteristics result in low energy utilization ratios and serious environmental pollution problems. The control of urban environmental pollution by changing the way we consume energy is an urgent task. To protect the environment, we must rapidly improve our present practice of directly burning coal on a large scale and pay attention to coal gasification and liquefaction. The solution of urban energy problems lies in energy recycling. In short, we must take a multitude of effective steps to protect the environment and work hard to build China into a clean, modern nation.

Whether it be energy development, energy conservation, environmental protection or energy transportation, funds are necessary. A shortage of money limits the development of the energy industries while its irrational use slows down economic growth. To ensure adequate funds to finance energy developments, we must open up various funding channels. Apart from central investments, we must mobilize local enthusiasm for fund-raising and make use of foreign funds rationally under the principles of equality and mutual benefit. To obtain maximum economic returns on our investments in energy conservation, we must analyze economizing measures soundly and target such investments primarily at departments, enterprises and facilities which can make significant savings promptly and effectively or at localities with a serious shortage of energy.

China's energy future is bright but the tasks ahead are also arduous. We must work harder in energy development, energy utilization and environmental protection, thereby contributing to the achievement of the strategic objective of quadrupling the nation's total industrial and agricultural output value.

12581

CSO: 4013/36

## NATIONAL POLICY

ARTICLE CONCLUDES THAT CHINA SHOULD FOLLOW WORLD DE-EMPHASIS OF NUCLEAR POWER

HK050941 Beijing SHIJIE JINGJI in Chinese No 9, 10 Sep 84 pp 35-39

[Article by Yang Haiqun of the Economic Institute of the State Planning Commission: "On the Decline of the World Nuclear Energy Industry"]

[Text] In the United States, there is a Worldwatch Institute, funded by many different organizations, which studies questions of global strategy. The institute's director, Chester Brown visited China this year. In his speech at the International Club on 19 April, he pointed out: "As China enters the era of nuclear power use, it should be very careful, because from its experience with nuclear energy, the United States has come to feel that it has the problem of being uneconomical, and nuclear power station construction is running into problems in countries all over the world, including Japan and France, whose programs have gone ahead relatively fast. No nuclear power stations have been ordered in the United States since 1976. It should be realized that not only has nobody purchased a nuclear power facility for the last 8 years, but nobody will do so ever again in the United States. This is by no means a response to the wrath of environmental specialists, nor is it due to a lack of governmental support, but the result of market factors. If you were a power specialist and called people on Wall Street to discuss the issue of nuclear power station construction, I'm afraid nobody would even attend the meeting."

Relevant data confirms that Brown's words reflect from the American side a worldwide decline in the nuclear energy industry.

### 1. Cutbacks in World Nuclear Energy Project Plans

In 1979, the OECD estimated that by 1985, its U.S. and European members plus Japan would possess 563,000 megawatts of nuclear energy generating capacity, representing about half of the total power generating capacity of these countries. Since 1970, however, the nuclear power generating capacity of OECD member states has been cut by two-thirds of the original plan. Today, nuclear power stations now in operation represent less than half of the number initially estimated. Present estimates for 1990 show that the scale of the nuclear power industry is now no more than one-third of what it was planned to be in the past.

Japanese specialist on nuclear energy and the Middle East question, Shigeki Koyama, used the table of the Japan Nuclear Energy Industry Conference in April of this year to show the cancellations of nuclear reactors in the United States: from 1972 to 1983, a total of 103 atomic reactors were cancelled in the United States, representing a net cut of 117,859,000 kilowatts of generating capacity. The United States was the first to develop nuclear energy, and its cutbacks have also been the biggest. The U.S. Congress Technology Evaluation Bureau published on 7 February of this year a survey report entitled "Atomic Energy Which Does not Define the Age", in which it pointed out that: "If no great changes take place in such aspects as technology, management, and popular attitudes, it will be unrealistic to expand the atomic energy program beyond projects already under construction."

Table 1: Table of cancelled atomic reactor contracts in the United States (units: 10,000 kilowatts pulse generating capacity)

	<u>No of Plants</u>	<u>Generating Capacity</u>
1972	6	586.1
1973	-	-
1974	8	871.9
1975	11	1,257.8
1976	2	242.3
1977	9	1,027.9
1978	13	1,395.3
1979	8	986.5
1980	16	1,877.6
1981	6	611.1
1982	18	2,303.6
1983	6	625.8
TOTAL	103	11,785.9

Source of statistics: Japan Atomic Energy Industry Conference "An Overview of Atomic Energy Power Stations" (effective to 31 Dec 1983)

Over the past few years, U.S. nuclear power stations have been in a highly depressed state, and the nuclear fuel of the Energy Department has not found any buyers. At present, the Nuclear Energy Department is cutting prices and production, and delaying plans for expanded production of nuclear energy totalling several billion U.S. dollars. Its fuel enrichment plants are at present working at less than half capacity. Since 1978, there has been not one single order for a nuclear power station. Other statistics state that during the past 9 years, only two nuclear power stations ordered have not been cancelled; some have been abandoned after only 10 or 20 percent of the construction was completed, while in 1982 alone, reactors were abandoned which had already consumed as much as \$5.7 billion in investment, bringing the total investment figure for abandoned nuclear power stations to \$10 billion. Meanwhile, from 1975 to 1983, U.S. coal-fired power plants increased capacity by 58,000 megawatts.

Outside the United States, the public corporations of the majority of other countries have also made large-scale readjustments in their nuclear energy plans. Since 1978, the commissioning of nuclear power facilities has only increased at 10 percent, almost all in France. There has been very little increase in either Britain or Federal Germany; while there has been a drop in Spain, Sweden, Switzerland, and Italy. In 1983, a high-level French Government commission published a long-term research report stating that by 1987, France would not commission any more new nuclear power stations. In Japan, whose reactor technology is now the most advanced in the world, the nuclear generating capacity goal for 1995 has now been reduced by 13,000 megawatts, and there are indications that it is slowing down the schedule of the nuclear energy program. The Soviet Union has also slowed down the development of its nuclear energy, and according to reports, the Soviet Union is still 6,000 megawatts off reaching its present 5-year plan target. According to present plans, by 1990 the developing countries will possess no more than 20,000 megawatts of nuclear generating capacity, or only one-seventh of what the IAEA predicted in the early 1970's. Taiwan Province, which actively developed nuclear power stations in the 1970's, had slowed down its rate of development by 1982, and had delayed the construction of several reactors indefinitely. By the early 1980's, South Korea had also decided not to commission any further nuclear power stations.

## 2. The Rise and Fall of the Nuclear Energy Industry

From 1951 and 1954, when the United States and the Soviet Union respectively began construction of small-scale reactors, until the 1960's, the nuclear power industry was in the experimental stage. During this period, only the United States and the Soviet Union invested in nuclear power stations, and though several other industrial nations had their own plans, they were all hindered by the Soviet-American monopoly. In the mid-1960's, the nuclear energy industry entered the stage of commercial growth. Not only did U.S. power plants increase many times over, but U.S. corporations, guided by governmental plans, began to sell nuclear technology to Europe, Japan, and some developing countries. The oil crisis of 1973-1974 pushed the development of the nuclear industry to a high wave, and during those 2 years U.S. corporations were involved in the construction of 126 nuclear power stations. Between 1971 and 1974, a total of 200 such stations were commissioned throughout the world. But as soon as this high wave had passed, the industry entered its fourth stage of slowed development. The United States was the first to cut its nuclear energy program, while many other countries reduced theirs to varying extents. Even so, by late 1983, there were 282 commercial nuclear power stations in 25 countries, with a generating capacity of 173,000 megawatts, able to provide around 9 percent of the entire world's electricity needs, or 3 percent of all energy needs. The proportion of nuclear energy in overall energy generation has differed widely in the various industrial nations: 40 percent in France; 17 percent in Japan; 13 percent in the United States; and 6 percent in the Soviet Union. However, the picture of nuclear energy industry development was an extremely dismal one. According to a survey produced by the U.S. Worldwatch Institute, the industry will have entered a period of complete stagnation by the latter part of the 1980's. The sketch drawn by Shigeki Koyama in Japan's "World Report" makes

it clear that between 1972 and 1983, commissioning of atomic reactors in the United States, Britain, France, West Germany, and Japan showed a tendency to drop; while plans for new construction of reactors between 1984 and 1991 showed a sharp drop.

### 3. The Reason for the Decreased Rate of Development in the Nuclear Energy Industry

The situation differs in each country, and reasons are manifold. Nuclear energy has met a series of unsolved problems, including the safety problem, the problem of handling nuclear waste, and the decommissioning of nuclear plants. But the main reason for the decline in the nuclear energy industry has economic roots. For example:

1. The nuclear energy industry is a highly capital intensive industry, with high construction costs. There is a long period from the design to the operation stage, during which high capital investment is required, investment which has become the number one detrimental factor in public investment budgets over the last few years. Ever since the first commercial nuclear power station went into construction in the early 1960's, capital estimates for U.S. nuclear power stations have risen steadily. Since the mid-1970's, cost estimates for private nuclear power plants have doubled every 4 years, faster than the price of gasoline, housing, or any other main item of expenditure. For the reactors built in the United States in the early 1980's, each kilowatt of electricity required an average investment of \$2,000 (at 1982's dollar rate), over 100 percent higher than coal-fired power stations. Its high costs and long construction period make a nuclear power station three times as expensive in terms of fund raising requirements as a coal-fired power station, and increases average construction expenses by about \$500 million. "Success stories" of nuclear power station construction are very few, with the ones which have been successfully completed having difficulties with expenses exceeding the budget, and the appearance of phenomena which would be seen in any other industry as losing operating capacity. In the United States, investment in nuclear energy construction has risen from \$2 billion in 1970 to \$19 billion in 1982, representing a three-fold increase even after deductions for inflation have been taken into account. Yearly overspending is comparable to the total budget of many other countries. Data from public utilities corporations in Japan show that actual yearly construction costs in Japan rose from \$350 per kilowatt in the early 1970's to \$1,000 per kilowatt in the early 1980's (at the 1982 U.S. dollar rate). Japanese nuclear energy experts have pointed out that nuclear power station construction costs are getting increasingly high, and that their inflation rate is not only higher than the inflation rate of goods prices, but also higher than the inflation rate of construction expenses for power stations powered by oil and other fuels. Britain's Central Electricity Board has admitted that the cost of its recently-constructed air-cooled nuclear power plant is equivalent to twice the cost of constructing a coal-fired power plant. West Germany has a larger and more successful nuclear energy program than that of Britain, but there are huge cost problems involved in it. Official figures gathered by West Germany's largest public utilities corporation shows that from 1969 to 1982, direct nuclear energy construction costs increased 600 percent, while costs for fuel-fired power stations rose only

350 percent. The Freiburg Institute's 1983 research report points out that due to rapid increases in construction costs and interest rates, construction costs for nuclear power are at least 60 percent higher than those for coal-fired power. In a recent 5-year plan report, Soviet officials announced figures showing that construction costs were 80 to 100 percent more for nuclear facilities than for coal-fired facilities. According to the builders of Canada's heavy water uranium reactor nuclear power stations, construction costs have risen from \$400 per megawatt in 1972 to \$1,700 per megawatt in the early 1980's which even after deductions to compensate for the inflation rate, mean an average annual rate of increase of 6 percent.

Now, the ribbon-cutting ceremony for a new nuclear power station often becomes a symbol showing that the world has entered a new stage which will push electricity expenses up 30 to 50 percent.

2. The operating costs of such stations are also high. In the 1970's, the operating and maintenance costs for U.S. nuclear power stations rose at an average annual rate of 18 percent. By the early 1980's, average annual running costs exceeded \$30 million, increasing the cost of producing the electricity by 20 percent. The various stations operate at an average of less than 60 percent of their standard capacity, rather than at 75-80 percent as had been imagined; this has also proved damaging to the economic efficiency of U.S. nuclear power stations. Many stations, due to a series of technical problems, are only semi-operable, frequently having to shut down for repairs. And due to the fact that construction expenses accounts for two-thirds of the cost of a nuclear power station, whether or not the station is in operation, the construction fees have already been paid; and a low utilization rate will mean a massive increase in generating cost. Overspending is frequently the main subject for discussion at meetings of boards of directors and commissions of inquiry. Detailed analysis and planning of over 30 U.S. nuclear power stations to be completed by the mid-1980's has shown that the electricity they produce will cost an average of 10 to 12 cents per kilowatt-hour (at the 1982 dollar rate). This is 65 percent higher than the cost of coal-fired generation, and 25 percent higher than oil-fired generation. Data provides thorough proof that in the United States, nuclear power stations are no longer a worthwhile proposition. Difficulties encountered in production technology and organization in the Soviet Union and other countries, including labor management and delays caused by builders and suppliers, has also slowed down the rate of development. The Soviet authorities have already admitted the existence of the problem of massive overspending on nuclear power stations. France's nuclear power construction program is famous throughout the world for its efficiency and speed, but since 1982, many French nuclear power stations have not produced good profits from operation, and costs may rise. France's nuclear energy program has become a massive burden on the capital market, and Electricite Francais has been forced to reschedule debts and to borrow money widely from the European bond market to maintain its existence. In 1982, the company's director pointed out that public utilities were in their worst financial state in 30 years. Overspending has also become an acute problem for Japan's nuclear power stations, which have had to shut down at various times for repairs, and often face the threat of earthquakes. The first of the Philippines' nuclear power stations was built on an earthquake

faultline, and can only maintain production through constant seismic testing which delays operation and leads again to overspending. The situation in India's nuclear power station operation is also bad, and the Indian Government has admitted that nuclear power generation is much more expensive than coal-fired power generation. In short, overspending in successive years on nuclear power stations has meant that for the majority of countries, the nuclear industry has no economic attraction whatsoever.

3. The costs for decommissioning and waste disposal for nuclear power stations are increasing steadily. On the one hand, the problem of nuclear waste (including waste nuclear fuel and damaged rods) is extremely difficult to handle, and transportation costs are high; and on the other hand, there is the problem of costs for decommissioning old plants. For example, some nuclear power plants in the United States have been decommissioned after reaching a certain stage of construction, and this had cost a total of \$14 billion by the end of last year. Investors on Wall Street have two bills for nuclear power stations, one for building expenses, and the other for decommissioning. To this day, nobody is clear on the size of the latter bill. No wonder London University professor J.W. Jeffrey stated that "nuclear energy was never economical, is not economical now, and will be even less economical in the future."

4. The long-term economic stagnation in Western nations and the reduced plans of some developing countries forced by serious debt crises have reduced the electricity demands of these countries, and increased the risk of nuclear power project investments. The rate of increase of the United States' energy needs has dropped from the 7 percent of 10 years ago to today's 1 to 3 percent; in France, the rate of increase in demand for electricity has slowed since the late 1970's, and in 1982 the French Government decreased its estimate for the country's electricity increase for the 1980's by 50 percent. This means that by 1990, France will have at least 13 percent surplus energy generating capacity. The majority of public utilities companies have no way of predicting correctly what effect this massive change will have, and have no choice but to be circumspect in drawing up future plans.

Though France has begun to experience an economic recovery since last year, many economists have recently pointed out that the United States, which began its economic recovery first, has begun to slow down. Economic growth in other countries is also highly unbalanced. Even in a situation of strong economic recovery, high interest rates and tight money markets are unlikely to change. In a situation of high interest rates and low share prices, companies deficient in funds, in order to complete their plans, will make efforts to raise funds. But people will begin to go against purchasing shares in these companies, and many companies will be terrified of investing in nuclear power stations. A certain management bureau chief who used to have the biggest plans in the United States for nuclear power construction said: "Nuclear power costs are not only high, but are difficult to estimate. No capitalist with any wisdom will plan to carry out a construction program on a project which he doesn't know how much it will cost, and therefore cannot possibly estimate its cost-effectiveness." The U.S. Congress Technology Evaluation Bureau has pointed out that "due to the fact that future energy needs are difficult to estimate, the fact that equipment investment costs are

too high, that there are many operation and management problems, legal restrictions are constantly being strengthened, and there is steadily rising opposition from the people, atomic energy in the U.S. now presents many investment risks." The OECD Atomic Energy Board, which used to have a highly optimistic attitude, came to the conclusion in 1982 that "in an atmosphere of change and uncertainty in the market, the nuclear energy industry now faces the danger of being commercially unviable." Many countries, in order to avoid repeating the same mistakes as the United States, cannot but adopt a highly cautious attitude.

5. Developing countries also face certain special difficulties in carrying out a nuclear power program. One important barrier to the development of nuclear energy in the countries and regions of the Third World is that their power networks are very small-scale. The IAEA has estimated that only India, Pakistan, South Korea, and Taiwan Province have a power network sufficient to install a conventional nuclear power station of 1,000 megawatts. Apparently, the per-kilowatt construction costs for a 200-megawatt "miniature reactor" are over 200 percent higher than those for the construction of a 1,000 megawatt nuclear power station, which makes small-scale nuclear power stations even less economically attractive. The capital-intensive nature of nuclear power stations put another burden on developing nations which already have all sorts of debts to pay. In particular, since most of the money for such projects must be spent abroad, foreign exchange resources will be exhausted. Therefore, the majority of developing countries see substituting importation of nuclear energy for oil importation as a way of saving money. Obviously, the prerequisite for the construction of a new nuclear power station is relatively speedy improvement in economic conditions. Even if a nuclear power station is built, judging by the experience of various countries, it is best planned and managed by the central government. A central government will pay serious attention to the standardization of nuclear power station designs, to avoid environmental pollution and take account of the effect of the environment on nuclear power stations (such as earthquakes) otherwise, costs will be even higher.

#### 4. Choosing a Future Nuclear Energy Strategy

The influence of cold economic realities on nuclear energy is something which the tens of thousands of demonstrating masses, burning with righteous indignation, have never gone into; these realities have put a stop to the blind development of the nuclear energy industry, and sobered up the people who "rushed headlong" into building nuclear power stations. By now, the majority of U.S. companies have publicly announced that they will no longer consider including nuclear energy in their power generation plans for the next 10 years. It should be pointed out that the various countries involved have not yet included the damage to the human environment of nuclear pollution in their power cost estimates. Some specialists persist blindly in publicizing the question of nuclear power "safety," hardly realizing that great sacrifices will have to be made for this safety, and moreover that the necessary technological and management levels will be hard to attain.

There are two different estimates as to the future of nuclear energy. One is that the current decline in the nuclear energy industry is temporary, and that sooner or later, with the increase in energy needs and the rise in standards of management and science and technology (for instance breakthroughs in nuclear fusion technology), it will develop further. The other estimate is that now, the issue is not whether or not to make certain small-scale readjustments, but that it is necessary to realize that the nuclear energy industry has become a dying industry, and it is not long before it will decline to nothing. The common feature of these two estimates is that the nuclear energy industry is in a state of decline, and that there exists the problem of the industry being uneconomic. Apparently, even Japan, which has such a serious lack of natural resources, is gathering experts from other countries to discuss this problem.

The "1984 World Situation Report" put out by the U.S. Worldwatch Institute contains an article written by Christopher (Fulaiwen) [1133 5490 2429], entitled "A Re-evaluation of the Economic Viability of Nuclear Energy." The article points out that for developing countries, careful consideration is necessary on the question of whether nuclear power represents a wise use of scarce resources.

Nuclear energy creates very few job opportunities, and makes Third World countries more dependent on foreign governments and companies than any other investment project. Nuclear energy projects not only cause environmental pollution and affect the lives of generations of people, but represent prime targets for military attack. In his opinion, we have a wide margin of choice, and the wisest overall goal must be the maximum energy at minimum cost, taking into account the effect of each sort of energy on the environment and the costs that this will involve in each case. Coal is by no means an attractive choice, since the acid rain produced by coal causes particularly serious losses to health and the environment in developing countries. Hopeful choices lie in renewable power resources such as small hydropower stations, geothermal energy, bio-energy, wind power and photo-electric solar power. Simultaneous generation of heat and electricity is a fast-developing method we could choose. Though the costs for these resources are at present about the same as those for coal and nuclear energy, while the costs for these new types of energy are gradually dropping, those for coal and nuclear energy are continuing to rise (see table 2).

Table 2. Estimated Generating Costs for Power Stations Built in 1983 and Predictions for 1990 (at 1982 dollar rate, U.S. cents per kilowatt)

Power Source	1983	1990
Nuclear	10-12	14-16
Coal	5-7	8-10
Small Hydropower	8-10	10-12
Production-related Electric	4-6	4-6
Bio-energy	8-15	7-10
Wind Power	15-20	6-10
Solar Power	50-100	10-20
Energy Efficiency	1-2	3-5

[Neng Xiao 5174 2400]

Moreover, new energy resources can be built on any scale. As for investment in rural electrification, the use of small-scale renewable resources or high-temperature wood-burning stoves would be much more effective. In addition, the active formulation of energy efficiency plans and the carrying out of effective investment will save large amounts of power and costs. In fact, the United States and other countries are now investing in renewable energy resources such as windpower, solar power, and so on. Chester Brown has pointed out that "the United States, which led the world into the age of nuclear power, may very well be the country to lead the world out of it." The Soviet Union and East European countries are now actively making use of methane gas, hydropower, solar power, wind power and geothermal power. Soviet energy experts estimate that by 2100, solar power will satisfy one-fifth of the world's energy needs. The Soviet Union plans to build a series of solar power stations with a capacity of 3,000 to 5,000 kilowatts between 1981 and 1985; it also plans by 1985 to build a wind power generating complex with an installed capacity of up to 5,000 kilowatts; and it is estimated that by 1990, 15,000 wind-powered generators will be built in the countryside. Romania has decided that by the year 2000 it will build several thousand more wind-powered generators with capacities ranging from several thousand watts to 1,000 kilowatts. The Soviet Union is presently preparing to build a large-scale geothermal power station with an installed capacity of 200,000 kilowatts. Hungary has put research and use of geothermal resources before coal, oil, and natural gas, and is carrying out widespread use of it.

China is also facing a decisive choice in terms of energy strategy: Primarily, this involves the choice between whether or not to make nuclear energy a long term energy development strategy. In my opinion, from the point of view of economics and safety, the best that can be said is that nuclear energy does not at present possess the conditions. As for what the future holds, we have to wait for more research and experimentation. We should make renewable energy resources the emphasis of our long-term energy development plans, and speed up investment in this area in terms of personnel, finances, and materials. To this end, I propose the following: The speedy establishment of a renewable energy industry bureau, the drawing up of concrete plans, research into and use of all the various types of renewable energy, and the industrialization of this new science and technology as fast as possible. As long as we work really hard, even without nuclear energy we will not suffer a situation in which "there is a temporary shortage of energy resources." The second choice involves the question of whether it is possible to build a batch of nuclear power stations in the short term. In my opinion, with the exception of the projects which have already gone into construction, we should not start any more projects. We can use part of the foreign exchange set aside for the importation of reactors in the original plan to introduce technology, with the emphasis on solving weak links in the non-nuclear energy field and in transportation and communications, along with the development of new technology in the field of communications, and so on. The problem in most urgent need of solution in China is the irrational arrangement of the forces of production and energy resources. Henceforth, we must on the one hand continue to establish high-energy-consumption projects in areas where there is no lack of energy resources, and on the other hand plan a strategic shift, and continue to grasp the work of transportation and energy-conservation, and on the basis of overall balance, effect the stable development of the national economy.

CSO: 4013/58

## POWER NETWORK

### COAL SUPPLY TO MAJOR POWER NETWORKS SAID GREATLY IMPROVED

HK130611 Beijing CHINA DAILY in English 13 Dec 84 p 1

[Text] The coal supply to China's major power networks has greatly improved, thus easing a critical fuel shortage which has already stopped the operation of several power plants.

A major railway project has also been completed to increase the annual coal-carrying capacity by 10 million tons.

According to statistics made available by the Ministry of Water Resources and Power on Monday, between 5 and 9 December the four major electricity networks in East China, Northeast China, Central China, and North China received 1.36 million tons of coal against the planned quota of 1.13 million tons, ECONOMIC DAILY reported yesterday.

The achievement is attributed to the joint efforts of the coal and railway departments and the local authorities concerned.

But there are still a few power plants suffering from shortage of coal supplies and some mines have not met their production targets. The total tonnage is more than 48,000 tons short. An investigation is being carried out.

Earlier, the Ministry of Coal Industry, in an emergency meeting, called on power and railway departments to work together in fulfilling this month's fuel supply quota to all power plants, especially the four major networks.

This was immediately echoed by the Ministry of Railways which, admitting a lack of competence in management in the past, took emergency measures.

The electrification upgrading of the Fengtai-Shacheng-Datong railway section--one of the country's key projects--was completed on Monday morning when the Datong junction at its west end was put into operation, BEIJING DAILY reported yesterday. Fengtai is in suburban Beijing, Shacheng in Hebei Province and Datong in Shanxi Province.

The section runs a total length of 379 kilometres on the Beijing-Baotou railway line and is an important route for coal from the Shanxi, Inner Mongolia, and Ningxia regions, the country's three major coal producers.

Experts said that the electrification of the section would increase its annual transport capacity by 10 million tons.

The section had been upgraded several times since 1949, raising its transport capacity 10 times. But it still could not meet ever-growing coal production targets according to the limited transport capacity, the industrial bases in East China, Northeast China and some other regions had to set theirs in line with the inadequate coal supply.

From now on, every 10 million tons of coal exported by this section will add 17 billion yuan to national industrial output value and 4.2 billion to tax and profits, according to an estimate by the State Statistical Bureau.

The project began in June 1982 with a total investment of 450 million yuan and had been scheduled to finish by the end of this year.

CSO: 4010/50

## POWER NETWORK

### POWER GENERATION UP BUT STILL UNABLE TO MEET DEMANDS

HK160609 Beijing CHINA DAILY in English 16 Nov 84 p 2

[Article by staff reporter Xu Yuanchao]

[Text] China has met its 1985 goal for electricity production 1 and one-half years ahead of schedule but the power shortage is still serious in many areas this winter, according to Qian Zhengying, minister of Water Resources and Electric Power.

Qian told CHINA DAILY both industry and agriculture have been growing rapidly in recent years. "Power generation this winter will be 5 percent more than last winter, but it still can't meet the soaring demand."

PEOPLE'S DAILY estimated that China has a shortfall of 10 million kilowatts of generating capacity, or 40 billion kilowatt-hours a year. Because of the lack of electricity, 20 percent of China's productive potential is not realized, the paper said.

The shortage will not be overcome for many years, a condition that will be more serious for coastal areas that are more advanced in economic development.

The State Council has called for speeding up the development of the power industry in an attempt to keep pace with the growth of the national economy, Qian said.

China has rich energy resources. The problem is how to raise the money to use them, Qian said. In addition to investment by the state, the ministry intends to tap local funds for construction of power plants. It also will try to attract foreign capital to set up joint ventures, and [build] nuclear, thermal, and hydropower plants in the four special economic zones and 14 open coastal cities as well as on Hainan Island. A rough program for development of the power industry in the Seventh Five-Year Plan is being discussed in the ministry.

China's power industry mainly depends on government investment. Local funds will be sought only to supplement state investment, she said.

CSO: 4010/38

## POWER NETWORK

### GUANGDONG SPEEDS UP CONSTRUCTION OF POWER TRANSMISSION PROJECTS

HK020904 Beijing ZHONGGUO XINWEN SHE in Chinese 0703 GMT 27 Dec 84

[Report. "Remarkable Results Attained in Construction of Power Transmission and Transformation Projects in Northern Guangdong Province--ZHONGGUO XINWEN SHE headline]

[Text] Guangzhou, 27 Dec (ZHONGGUO XINWEN SHE)--The construction of small hydropower transmission and transformation projects has been speeded up in recent years in Northern Guangdong Province's mountain areas, thus ending the situation in which it is difficult for electricity to be transmitted to the large power transmission network and attaining marked economic results.

Of the 12 counties under the jurisdiction of Shaoguan City, 11 are carrying out the construction of a whole range of transmission and transformation projects. Since the beginning of 1984, four 110,000-volt transformer stations and sixteen 35,000-volt transformer stations have been put into commission, with the corresponding transmission line totalling 249 kilometers. Moreover, the construction of nine additional transformer stations is being stepped up.

Since 1978, the mountain areas in Northern Guangdong Province have always ranked first in the province in terms of power station construction, with an average installation capacity of an additional 25,000 kilowatts per year. At present the city has completed the construction of 579 small hydropower stations, with a total installation capacity of 256,000 kilowatts. However, the construction of necessary transmission and transformation project falls short of the demands of the situation. It is particularly so with the case of the three border counties---Yangshan, Liannan, and Lianshan. When river waters rise, they will sustain economic losses, because a total of about 70 million kilowatt-hours of electricity cannot be transmitted to the large power transmission network. Although electricity production in these areas was affected by a decreased amount of rainfall this year, thanks to a considerably great improvement in transmission and transformation equipment, of this year's electricity production of 220 million kilowatt-hours, apart from 100 million kilowatt-hours that were set aside for their own use, another 100 million kilowatt-hours was smoothly transmitted to the large power transmission network, thus attaining marked economic results.

CSO: 4613/73

## POWER NETWORK

### BRIEFS

JILIN POWER ACHIEVEMENTS--As of 14 December, Jilin Province prefulfilled and overfulfilled its power production plan by 17 million kWh, a 360 million kWh increase over the 1983 figure. [Excerpt] [Changchun Jilin Provincial Service in Mandarin 1030 GMT 18 Dec 84 SK]

SHANDONG POWER ACHIEVEMENTS--After prefulfilling the 1984 plan for industrial power production and construction by 19 days, the Shandong provincial power industry front also prefulfilled the electric energy production plan governed by the Sixth Five-Year Plan by 375 days. Since 1981, the front has set up seven new high-heat-resistant and high-voltage generating units and has put them into production, with an installed capacity of 800,000 kW. [Excerpts] [Jinan Shandong Provincial Service in Mandarin 2300 GMT 20 Dec 84 SK]

JIANGXI POWER CONSTRUCTION--Jiangxi has achieved good results in building capital construction projects for its power industry, and ranks fourth in the whole country in increased power generating capacity this year. Focuses of this year's projects are the installation of a 125,000-kilowatt power generating unit for Jiujiang and Guixi, and three power transmission lines between Nanchang and Guixi, Guixi and Yongping, and Jingdezhen and (Sizhoumiao). The 220,000-voltage transmission line between Guixi and Nanchang was completed 132 days ahead of schedule. [Summary] [Nanchang Jiangxi Provincial Service in Mandarin 1100 GMT 13 Dec 84 OW]

JILIN POWER TRANSMISSION PROJECT--The Jingdunyan 220,000-volt power transmission and transformation project, one of the key projects of the Ministry of Water Resources and Electric Power, passed examination today and proved to be up to the quality standard. With an investment of 46 million yuan, this project includes a power transmission line and two substations. The 220,000-volt ultrahigh-tension power transmission line begins at the Jingpohu power plant in Heilongjiang, runs through Dunhua County, and ends in Yanji, totaling 233 km in length. The two substations are located in Dunhua and Yanji; each has a 63,000-KVA capacity. Supplying the power from the eastern part of the Northeast power grid to Yanbian, this project will greatly ease the power shortage of Yanbian Korean Autonomous Prefecture, and will have great strategic significance in developing its industrial production and revitalizing the economy of minority nationalities. [Text] [Changchun Jilin Provincial Service in Mandarin 1030 GMT 27 Dec 84 SK]

NEW POWER COMPANY STARTED--The Shanghai Joint Power Station Construction Company, jointly formed by Shanghai's electrical equipment manufacturing enterprises and related research, design, engineering and construction units, was recently inaugurated. This company chiefly undertakes to construct thermal and nuclear power stations and manufacture power transmission facilities and power station buildings. It will break through regional, departmental, and administrative boundaries and strive to enhance the present ability to build power generator sets of a little more than 1 million kilowatts to that of building over 10 million-kilowatt generator sets in the Seventh Five-Year Plan period. Huang Yicheng, vice minister in charge of the State Planning Commission, and Wang Daohan, mayor of Shanghai, attended the inaugural ceremony. [Text] [Shanghai City Service in Mandarin 2300 GMT 5 Jan 85]

GUANGDONG ELECTRICITY OUTPUT--Guangdong Province fulfilled its quota for electricity output for 1984 10 days ahead of schedule. Electricity output was some 400 million kilowatt-hours more than in the original plan. Due to less rainfall in 1984, the province's hydroelectric output was some 700 million kilowatt-hours less than in 1983. The provincial Economic Committee and the provincial Electric Power Department took vigorous measures to generate more thermal power so that the thermal power plants increased electricity output by some 1 billion kilowatt-hours. [Summary] [Guangzhou Guangdong Provincial Service in Mandarin 1000 GMT 2 Jan 85 HK]

POWER OUTPUT FULFILMENT--By 18 December, China had fulfilled its 1984 power generation plan of 360 billion kilowatt-hours, showing a 7 percent rise over the power output for the corresponding period of last year. The total power output in the country by the end of this year is expected to reach more than 370 billion kilowatt-hours. [Summary] [Beijing Domestic Service in Mandarin 2230 GMT 18 Dec 84 OW]

HUNAN ELECTRICITY OUTPUT--The workers of the Hunan Provincial electric power system seriously redeemed their pledge of generating 5.4 billion kilowatt-hours in the second half of this year which they made to the provincial government. On 18 December, they fulfilled their production quota for the whole year ahead of schedule. Electricity output by 18 December was 320 million kilowatt-hours more than in the same period last year. [Summary] [Changsha Hunan Provincial Service in Mandarin 0100 GMT 29 Dec 84 HK]

NORTHEAST MEETS 34 TARGET--As of 24 December, the Northeast China Power Industrial Administration Bureau had fulfilled its 1984 target for generating 57.36 billion kWh of electricity. It is estimated that an additional 1 billion kWh of electricity will be generated by the end of this year. [Summary] [Shenyang Liaoning Provincial Service in Mandarin 2200 GMT 25 Dec 84 SK]

CSO: 4013/73

## HYDROPOWER

### PUMPED-STORAGE STATIONS: ANSWER TO NORTH'S POWER SHORTAGE

Beijing GUANGMING RIBAO in Chinese 27 Oct 84 p 2

[Text] In a recent conference on pumped water storage hydropower stations in north China, more than thirty experts recommended that a major effort should be made to construct such stations in north China to relieve that region's electric power shortage.

The above-mentioned recommendation by these experts was aimed at creating a stable, peak regulation power source for the North China Grid. In 1983, the region's network experienced a peak-valley power shortfall of 1.5 million to more than 2.4 million kilowatts and it is now projected that by 1990 this shortfall will reach 4.75 million kilowatts, a problem calling for urgent solutions. The experts pointed out that major state construction of pumped-storage power stations or installation of such capacity in conventional power stations now under construction -- using surplus electricity at night and seasonal capacity to augment the power system's stability and flexibility -- would provide adjacent power grids with a peak-valley regulation capability, avoiding wasted output, enhancing economic benefit, and producing no pollution. Major construction of pumped-storage power stations in North China would be an effective way to resolve the region's peaking problem.

Pumped-storage generators can use water pumps and hydraulic turbines, making use of the system's surplus electricity during the load valley periods to pump water from a lower reservoir to a higher one to create a reserve. When the load approaches a peak period, the water is released from the higher reservoir to the lower one, converting potential energy to kinetic energy. Water flows through the turbine to generate electricity which is fed into the power system to play a regulatory role. Pumped-storage power stations have a high degree of flexibility facilitating peak regulation. In terms of yearly costs, they are more economical than equivalent backup facilities.

China got off to a late start in pumped-storage hydroelectric power stations: three oblique-flow, reversible generators with single unit capacities of 11,000 kilowatts were installed at the Gangnan and Miyun stations in the 1960's. The experts are proposing that a change be made in the current stagnant situation in pumped-storage power station construction and generator development to an all-out crash program in these areas in order to meet the power demands on the North China Power Grid.

CSO: 4013/56

## HYDROPOWER

### CURTAIN GOES UP ON PREPARATORY WORK FOR THREE GORGES STATION

Wuhan HUBEI RIBAO in Chinese 29 Nov 84 p 1

[Excerpt] Preparatory work for the initial phase of construction on the Three Gorges hydroelectric power station on the Chang Jiang is now unfolding on both banks of the river.

On 9 May 1984, a crack advance contingent of construction personnel, along with their machinery and equipment, were organized to form the Three Gorges Key Project Initial Phase Preparatory Work Command and ordered to set up camp at Letianxi, some 6 kilometers from the dam site. With the all-out support from the local government and people, within the space of a little over 6 months they had built a vehicle ferry, opened a short access road into the site, put in the necessary power and water systems, established communications links with the outside, and even began the work of levelling the construction site.

The Three Gorges hydropower station, with an installed capacity of 13 million kilowatts, is five times the size of Gezhouba, currently the nation's largest hydroelectric power station. It has comprehensive economic benefits, including power production, flood prevention, and navigation and represents an enormous effort on the part of the Central Committee and the State Council to build a key project to resolve the nation's energy demand for its economic take-off before the end of this century.

For the last 20 years and more, the unit responsible for the planning of this project, the Chang Jiang River Valley Planning Office has been drawing up designs, conducting surveys, and making plans. Last year they completed the feasibility study report for the Three Gorges project and the follow-on initial planning stage is nearing completion.

CSO: 4013/68

## HYDROPOWER

### TIANSHENGQIAO FEASIBILITY STUDY, SURVEY WORK COMPLETED

Beijing SHUILI FADIAN /WATER POWER/ in Chinese No 9, 12 Sep 84 p 6

/Article: "Tianshengqiao Hydroelectric Station Site Selection and Feasibility Study Tasks Completed Smoothly"/

/Text/ In mid-April 1982, the Kunming Survey and Design Institute received the task of surveying and designing a site for the Tianshuiqiao high dam hydroelectric station. In May the exploration team visited sites, in July the exploratory work began in earnest, and at the end of the year the "Site Selection Engineering and Geological Conditions" report was presented. A site selection technology symposium convened by the Institute of Planning and Design of the Ministry of Water Resources and Electric Power agreed on the dam site recommended in the site determination report and gave high marks to this phase of the work. The meeting pointed out that in the relatively short time of a year and a half the Kunming Institute had added a great deal of work to the foundation of work done by the Guiyang Institute, carried out analyses and comparisons of the strengths and weaknesses of the two sites in the earlier work (Dawan and Bapan), and finally settled on the Dawan site and created the conditions for accelerating construction of the Tianshengqiao hydroelectric station. Later, in March 1983, the Kunming Institute began the feasibility stage of the exploration work and at the end of January 1984 presented an engineering geology report and drawings. This report was also reviewed and approved within the institute in April of this year. To summarize the past 17 months, approximately 6,000 meters of drilling were completed, 2,000 meters of tunnelling, nearly 5,000 m<sup>3</sup> of trenching, and approximately 400 meters of tunnels. Maintaining quality and quantity, the site selection and feasibility study stages of the Tianshengqiao hydroelectric station exploration were completed with a speed rarely seen in recent years.

Why were these tasks completed so well? Apart from the great amount of work done and the good foundation laid by the Guiyang Institute and the 00619 Unit, as far as we ourselves are concerned, the reasons are mainly: 1) It was a crack unit and it worked quickly. After the mission was received, we formed a new exploration team immediately by transferring in 27 geological and survey personnel from exploration units and relevant departments, and 40 drilling, mountain, experimental, and logistical personnel. Team members had no dependents, were in good health, and did not have any encumbrances, so as soon as they reached the work site they got to work quickly on production and setting up camp. 2) We insisted on making geology the central focus and tried to improve

the quality of our work. After the exploration and measurement team was established, the concept of geology as the central focus was established all along the line, a production direction system centered on geology quickly took shape, targets were centralized, action was unified, quality was good, and efficiency was high. For example, in the site selection stage, we stressed the very important influence of engineering geology problems on site selection, such as the landslip, karst leakage, and major faults of the Bapan site, the soft and weak intercalated beds and stable slope of the Dawan site, and tried to emphasize confirming results to obtain breakthroughs. 3) We closely coordinated exploration and design to select the best proposal. In site selection exploration and design, designers visited the sites three times to ascertain the actual circumstances and discuss geological problems with geologists and proceeding from actual circumstances revised and compared engineering arrangements; geologists went to Kunming to discuss proposals and arrangements with the designers and to provide geological maps and data. This close cooperation created the conditions for the speedy presentation of the report.

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CSO: 4013/11

## HYDROPOWER

### BAISHAN PUTS THIRD 300MW GENERATOR INTO OPERATION

OW111755 Beijing XINHUA in English 1632 GMT 11 Dec 84

[Text] Changchun, 11 Dec (XINHUA)--A 300,000-kilowatt electricity generating unit went into operation today at the largest hydropower station in northeast China.

This is the third of its kind put into production in Baishan hydroelectric power station on the upper reaches of the Songhua Jiang in Jilin Province since the end of last year.

Two more units of the same capacity will be installed in the second stage of the construction for the Baishan station, official sources here said.

Baishan, the second hydropower station on the upper reaches of the Songhua Jiang, will eventually produce 2 billion kilowatt-hours of electricity a year, enabling supplies by the northeast China power grid to increase at least 30 percent.

Another power station is being built on the same river.

The northeast, which encompasses Heilongjiang, Jilin, and Liaoning Provinces, is China's leading heavy industrial center.

CSO: 4010/43

## HYDROPOWER

### MEASURES TO REDUCE FUTURE CONSTRUCTION COST AND TIME SUGGESTED

Beijing SHUILI FADIAN /WATER POWER/ in Chinese No 5, 12 May 84 pp 3-6

/Article: "Eighteen Measures on Doing Our Best in the 'Second Chapter'"/

/Text/ Editor's Note: The instructions of leading members of the Party Central Committee concerning "We must lower construction cost, select the most favorable program and shorten construction time" has aroused immense reaction from the water conservancy and hydroelectric power front. This is widely taken as the Party Central Committee's concern for and urging on us and is a basic guiding principle for speeding up hydroelectric construction in the future. In recent months, having earnestly studied and implemented these instructions, the broad masses of staff and workers of the units under the Water Resources and Hydro-power Development Corporation have put forward many good opinions and suggestions. On this basis, the corporation has proposed 18 measures on how to do our best in the "second chapter." This periodical is publishing the entire text and hopes the whole body of workers in water conservancy and hydroelectric power intensely study this problem, or inform us of your further opinions and suggestions on one or two points so that they can be continuously published here for interchange thereby contributing our strength in conscientiously doing our best in this chapter.

Planning and site selection must proceed from the overall interests of the state, persist on the overall point of view and pay particular attention to economic analyses and propose rational plans and programs by seeking truth from facts. We must carry out continuous cascade development in drainage areas, river sections, and regions which are rich in hydropower resources; the flow process can be practiced regardless of design and construction, and be consistent for, rational planning, low investment, and high work efficiency. At the same time, we should construct from high to low on all river sections and areas where conditions are favorable. This can simplify diversion and river damming engineering of all downstream cascades, give full play to the role of storage regulation of upstream reservoirs and increase power generation of all downstream cascades. Therefore, all river sections and areas with favorable conditions should be arranged this way as much as possible.

According to the plans of the Ministry of Water Resources and Electric Power this year we must put forward the "Draft Outline of Water Conservancy Construction" and the "Draft Outline of Electric Power Construction" by the year 2000,

do our best in drawing up the Seventh 5-Year Plan on water conservancy and electric power and strive to complete the supplementary plan for the drainage areas of the seven major rivers in about 2 years. We must soon put forward the preliminary designs or feasibility study reports for the water and electric power projects which have already been included in the early phase key tasks of the state. For cascade power stations under construction which can "use the large to lead the small," such as the Shitang, Xiaodongjiang and Xunyang projects, we must study measures to give play to the superiority of continuous construction, work hard to lower construction cost, and strive to begin construction as early as possible.

2. We should rationally plan the scale of hydropower stations and stress combining long- and short-term considerations. Based on long-term considerations we should appropriately install more generating units and discharge less water, fully utilize seasonal electric energy and satisfy the needs of peak regulation of power grids.

Along with the development of power networks, the role of hydropower stations in peak regulation is increasingly prominent. At present many hydropower stations already constructed or under construction have made requests to expand installed capacity. At the same time, in order to develop high power-consuming industry we need to fully utilize the seasonal electric energy of hydroelectric power. For this reason, we must stress combining long- and short-term considerations, considering overall economic interests, demonstrate the scale of rational installation of generating units in hydropower stations and install more units and discharge less water as much as possible. In arranging for design and construction we should strive for one-time implementation and avoid duplication of work and increase in capital outlay.

At present, we must strive for the construction of the Baishan expansion project to continue. We must intensify studies on capacity expansion of existing power stations in northeast and east China and do our best in making arrangements.

3. Do our best in overall arrangement in the construction of hydropower stations.

On this question, while stressing beginning production and obtaining benefits as early as possible, we must also speed up the windingup stage of construction, avoid the situation of carrying out production and construction at the same time even after the power station begins production. The longer windingup work drags on, the lower the work efficiency and higher the investment. For this reason, in constructing power stations with multigenerating units, as long as units can be supplied we should speed up installation as much as possible, concentrate on installing them and leave no unfinished work. Generally we should be able to install 2 to 3 units each year. The Gezhouba phase two project should strive to install 4 to 5 units each year.

4. In river planning and dam-site selection, we must select dam sites and dam types by suiting measures to local conditions.

According to present conditions in China's hydropower construction development, we must pay particular attention to preferential use of local-material dams.

Earth and rock-fill dams have good earthquake resistance and can better suit complex geological conditions. They can reduce the burden of cement supply which has a major practical significance to speeding up the development of China's hydropower construction. For this reason, we must stress this issue in planning, prospecting, design and construction and strive to make a prompt breakthrough in actual work. We must also exert ourselves in organizing the tackling of key problems in key dam-construction techniques for high earth-rock dams, research on dam construction on deep overburden, prospecting of complex foundations and research on engineering geology as well as speeding up construction in underground engineering and others which have been included by the state as key scientific research projects. We must also demand a certain achievement through the practice of the Lubuge project.

5. Continue to strengthen work in the early stage, strictly handle matters according to work procedures in this stage, assure the quality of work in the early stage and increase the storage capacity of hydropower construction projects.

In terms of work procedures in the early stage of hydropower construction, large projects can develop their work according to the four stages of river and river-section planning, feasibility study reports (reports on planned tasks), preliminary design and construction details. Super-large projects should also undertake technical design or technical design on special topics. Feasibility study reports must be launched on the basis of river planning and preliminary designs formally reported must be based on examined and approved feasibility reports. Prospecting work must also insist on following work procedures for prospecting. Only this way can we conscientiously assure the quality of work in the early stage and increase the storage of construction projects.

In order to suit the needs of the development of the national economy, we must strive to complete preparations within 3 to 4 years for the quadrupling of hydropower output. On the basis of the current preliminary designed storage of 10 million kilowatts, we must increase this capacity by an average of 10 million kilowatts in each of the next 3 years and enable the state to make selections.

6. Perfect the responsibility system of design work, strive to increase the level of design and assure design quality.

Design work must stress improved work quality, earnest verification and demonstration of the accuracy of basic data and calculated achievements, making designs excellent on the basis of a selection program. We must also further study ways to improve design investigation and strive to maintain continuity of design investigation so that the investigative conference can earnestly study and resolve problems and constantly improve the quality of design investigation.

We must build and perfect the responsibility system at all levels of work stations and the system of checks and approval by levels within design work. The chief design engineer (project director or deputy director) is the actual organizer of the design work of a construction project. We must stress the technical and economic aspects of design responsibilities shouldered by the chief design engineer for the construction project, define his duties, and safeguard his authority.

We must vigorously strengthen the capability of the construction site representative group for projects under construction so that design and construction are closely coordinated, problems at construction sites are promptly studied and resolved and the supply of blueprints are guaranteed. We must support the work of the design representative group, pay attention to resolving its actual difficulties and maintain its relative stability.

For the construction of key projects we can hire a small number of specialists to form a technical consultative committee to undertake consultative tasks and strengthen the supervision, deliberation and policy decisions of key technical problems in design and construction. At present, experimental points are planned for the Yantan project before it is gradually popularized.

7. Strengthen geological work, actively adopt advanced methods of prospecting and improve the quality of geological survey.

Improving the methods of prospecting and using advanced techniques in prospecting are important measures to speed up prospecting, improve its quality and reduce its cost. At present, in the field of survey we must continue to popularize the new techniques of aerial survey and land photography and popularize and expand the application of computers. In the field of geological survey, we must continue to popularize diamond bit drilling and give further play to the role of physical survey, and we must stress assimilation and use of advanced instruments and equipment. We must stress the actual effects of geological survey and strive to improve the quality of work in this area.

We must strengthen the building of prospecting contingents and set up a production command system centering on geology. Geology and design /units/ should strengthen their understanding, consultation, and coordination.

In order to suit the needs of implementing the technical and economic responsibility system, we should vigorously improve the labor organization and management system in prospecting and gradually build an allround prospecting production command system. At present, we can popularize the measures of the contractual economic responsibility system in trial use by the Dongfeng prospecting team of the Guiyang Office.

8. Vigorously promote standardization and seriation of design, strive to change the traditional handicraft work method, increase design speed and enhance design quality.

In the design work of hydropower construction, mechanical and power equipment, metallic structures and construction enterprises, we must vigorously promote standardization and seriation, constantly supplement and perfect on the basis of summarizing experience and gradually form a standardized and serialized data bank which is complete in categories and provide reference or use in transfer for design work in the future in order to shorten construction time, increase the speed of design and reduce the production and supply of nonstandard equipment in construction projects.

In the design of construction enterprises we should also develop assembly design in order to increase the speed of preparation work and benefit equipment reuse.

9. Further perfect the internal economic responsibility system of construction enterprises and vigorously promote implementation of investment apportioning according to construction projects.

All construction units must develop in the direction of production management type of enterprises, strive to improve their management and administrative levels, clearly define the economic responsibilities of enterprises and stress actual economic results. We must vigorously promote methods of investment contracts, promptly sum up experiences on the basis of the two experimental points of Gezhouba and Jinshitan projects and further expand the scope of experimental points. After preliminary consideration, experimentation is planned for the Hongshi, Taipingwan, Ankang, and Guxian projects.

Initial results have been made in implementing the internal economic responsibility system of construction enterprises and its basic form has tended to become centralized. We should conscientiously strengthen the groundwork according to concrete conditions of all units and gradually perfect it. At the same time, during its implementation, we must properly place the relationships of interests of the state, enterprise and the individual, ensuring that the state gets the larger share, the enterprise gets the medium share and the individual gets the smaller share.

10. Vigorously develop specialized construction contingents.

In light of the construction experience of large power stations abroad and the practice in our trial implementation of specialized contracts in the Hongshi project, specialized contingents have strong combat strength, act swiftly and have high work efficiency so that they should be the orientation of development.

Specialized construction contingents must be capable. We must train outstanding and key specialists and technicians and provide them with advanced equipment. They must perform all construction tasks assigned to them in a short period of time, at low cost and with high quality. Only this way will they be able to stand on their own, be competitive, and develop.

We can consider organizing various types and forms of specialized contingents among the construction units of the hydropower construction system, such as specialized engineering bureaus, specialized corporations, specialized engineering offices down to various small specialized teams. Specialized teams can undertake excavation in large projects, concrete work, installation of power units, foundation management and other projects. They can also undertake the design and construction of subsidiary construction enterprises as well as such concrete construction projects as prestressed cables and sliding forms. While they undertake the internal construction projects of various units they can also undertake specific tasks nationwide and even contracts abroad.

11. Strengthen the training of staff and workers, develop skills in many things and expertise in one and strive to increase productivity.

If the tasks of each construction stage of a hydropower project are not balanced, the work among different types of jobs will not be balanced. To prevent work holdups due to poor organization and increase productivity, we must develop skills in many things and expertise in one, that is, those in different types of technical work should become versatile. They must have expertise in their own type of job but must also be capable of undertaking the tasks of similar types of work. At present there is a higher proportion of young workers among all units whose technical level is highly unsuitable to the demands of using new equipment and popularizing new technology. For this reason, we must conscientiously strengthen the technical training of staff and workers and demand that we achieve one general training within the next 3 years. A system of evaluation must be strictly enforced during training. Those who are not qualified must not be allowed to take up major work posts and their wages should also be differentiated.

12. Do a good job in base construction, organize construction by the flow process on a large scale and arrange construction contingents according to the needs of the progress of a project.

This will reduce the number of onsite construction workers, lighten the burden of the management of livelihood and reduce the scale of temporary construction. This is an important measure to speed up preconstruction work, shorten construction time and lower construction cost.

We must earnestly do a good job in base construction so that construction contingents can have no fear of disturbance in the rear and take part in battle with nothing on their conscience. The rear base of all construction contingents is a living base, a training base as well as a production base. We must earnestly do a good job in overall planning and gradually develop it and make it complete. We must also implement the principle of more compensation for more work done; wages, rewards and subsidies must benefit encouraging staff and workers to go to the work site.

We should similarly do a good job in base construction for prospecting contingents which will help relieve prospecting personnel of their worries, strengthen the mobility of prospecting work, stabilize the emotions of staff and workers and strengthen technical training.

13. Earnestly carry out overall management in planning, quality control and economic accounting, ensure the quality of projects and strictly enforce statistical evaluation.

Ensuring the quality of projects is highly significant to hydropower construction. The lessons in the past are profound as problems in the quality of projects increased project cost and prolonged construction time. We must implement the demand that "a hundred years' plan, quality comes first," vigorously carry out overall quality control and improve work quality to assure project quality. We must vigorously launch activities of quality control groups.

All construction units must focus on the three construction management goals of quality, construction time and cost and establish a modern scientific management system which suits the characteristics of enterprises. At present, we must put particular emphasis on strict control of projects with external contracts and strive to increase the work volume of self-run construction and installation. We must also define and appraise productivity, cost reduction rate, equipment productivity and other targets at different levels and check on them with strictness.

Various targets demanded for 1984 are: general productivity, 4,500 yuan per capita; cost reduction rate, 8 percent; construction machinery fitness rate, 85 percent; utilization rate, 60 percent; machinery efficiency, 80 percent; equipment productivity, at least 0.7 yuan per yuan; economization of steel products, 3 percent; economization on timber, 10 percent; and economization on cement, 7 to 10 percent.

14. Actively promote the formulation and revision of technical regulations and standards and economic standard quotas and vigorously strengthen basic work.

The work of assigning technical and economic standard quotas is the basis for carrying out construction of projects, increasing management level, improving economic results and other tasks. At present, some of the standards in prospecting, design, regulations and standards of construction techniques, various expenses as well as assigned quotas for labor, materials and equipment no longer suit the demands of current construction of projects; moreover, some have not integrated with support projects and there are still gaps. For this reason, we must stress formulation or revision and use them to guide our work.

Feasibility study reports is a new stage of work in recent years. We should also promptly organize and draw up measures concerning the formulation of regulations and corresponding investment estimates, examine and approve them.

The budgetary estimate is an important component part of the design document; it is the basis used by the state to arrange capital construction plan and is the basis for investment apportioning. We must do a good job in its formulation and strive to gear it to actual circumstances. At the same time, we must strengthen economic analysis work and promote the development of design and construction.

15. Vigorously use and popularize new techniques

Developing technical advance is a basic measure to speed up hydropower construction, improve quality and lower construction cost. We must make new progress in adopting and popularizing new techniques as soon as possible. At present, we must exert our efforts in two areas to promote technical advance: First, in accordance with the key issues in China's hydropower construction, organize the tackling of key technical problems, particularly the various experimental scientific research projects which have already been listed by the state as key scientific research projects, and strive for early breakthroughs. Second, for achievements in various technological innovations from which experience has been obtained through practice, we must vigorously popularize them in

actual work and swiftly obtain real economic results. This has even more practical significance for shortening hydropower construction time and lowering construction cost. For instance, the "two blends and three forms" in concrete construction and presplit blasting, rockbolting, and shotcreting of underground engineering in rock excavation are effective and can be regarded no longer as new techniques. However, they are far from being comprehensively used in all construction sites, and by merely using them in earnest their economic results will still be impressive.

16. Continue to do a good job in consolidating enterprises, strengthen revolutionization in building leadership groups and strive to establish six-good enterprises.

Improving the quality of leadership groups is the key to improving the quality of enterprises. At present, we must stress the reorganization of the composition of leadership groups and establish a sound system of reserve cadres on the basis that leadership groups of all units have carried out initial reorganization and by continuing to conform to the demands of revolutionization, rejuvenation, enhancing the level of knowledge and specialization. We must strengthen the work of training, do a good job in building the third echelon and initiate conditions to supplement new leadership groups.

The work of consolidating enterprises must be carried out according to plan. We demand that all inspection and acceptance work be completed in 1984 and that a group of six-good enterprises be selected. At the same time, all units must do a good job in party consolidation according to the unified plan of the Party Central Committee.

17. Strengthen ideological building and strive to build a large hydropower construction force that has socialist consciousness.

Hydropower construction is an extremely arduous and glorious task. We must vigorously strengthen constant ideological and political work, combine ideological and political work with production and economic work, educate staff and workers to carry forward the revolutionary spirit of arduous struggle and diligence and thrift in doing pioneering work, establish lofty communist ideals, foster the selfless communist attitude in work, ardently love the hydropower undertaking and take root in it. We must remove spiritual pollution, correct the unhealthy tendency of "everything for the sake of money" and strive to improve the political quality of hydropower construction contingents.

18. Earnestly select project experimental points, do a good job in the work of exemplary models.

All units must take the Luan He /diversion project/ project as a model, work hard to discover one's shortcomings, earnestly do their best in "the second chapter," strive to create models and strive to be examples. The Water Resources and Hydropower Development Corporation has initially considered using the Yatan project as the experimental point and adopting the following measures:

(1) organize a technical advisory committee; (2) organize the Huadong /East China/ Office, Zhongnan /south-central/ Office, and other units to undertake

assigned tasks of design consultation or specific design projects; (3) organize the Gezhouba Engineering Bureau, No 8 Bureau, No 13 Bureau, and other units to undertake some of the design and construction tasks of construction enterprises as well as the tasks of left-bank earth and rock excavation and external transportation. This will concentrate the current superior capability in the hydropower construction system to speed up the construction of the Yantan project, work hard to lower construction cost and strive to produce good results and seek new experience through the experimental point.

9586

CSO: 4013/190

## HYDROPOWER

### SMALL POWER STATIONS BOOST RURAL ELECTRIFICATION

OW301723 Beijing XINHUA in English 1439 GMT 30 Dec 84

[Text] Beijing, 30 Dec (XINHUA)--China this year has built 1,421 small hydroelectric power stations, which have a combined generating capacity of 470,000 kilowatts, according to the Ministry of Water Resources and Electric Power.

Small power stations--those with a generating capacity of up to 12,000 kilowatts--throughout the country have generated 21.6 billion kilowatt-hours of electricity, up 8.41 percent over 1983.

The rapid development of small hydroelectric power stations has resulted from the efforts of 100 counties selected to pioneer the drive for rural electrification, the ministry said.

This has aroused interests in the surrounding counties, especially in southern provinces rich in waterpower resources.

Guangdong Province has increased its installed generating capacity by 38,000 kilowatts this year, and Fujian has 52,000 kilowatts of extra generating capacity.

The selected 100 counties must aim at supplying electricity to 90 percent of peasant households for lighting, and more than 20 percent of households for cooking, agricultural production, processing of farm and sideline produce as well as county and commune-run industries.

Rural people are encouraged to use their own funds to develop small power stations. Government subsidies are used mainly to help build stations with a generating capacity of up to 500 kilowatts each, which can use water heads of just a few meters to produce electricity.

While helping alleviate energy shortage in the countryside, small power stations are playing no small role in achieving an ecological balance.

In places where energy shortage is especially acute, peasants often fell trees illegally for firewood, according to earlier news reports.

CSO. 4010/58

## HYDROPOWER

### BRIEFS

PUBLIC BIDDING ON SHITANG STATION--Public bidding on the earthwork project for the Shitang hydropower station was held on 20 November in Hangzhou. Seven hydropower and construction companies from around the nation submitted bids. The event marked the first such domestic bidding on a hydroelectric power station construction project. In the competitive bidding, the difference between the high and low bids was 80 million yuan. The Shitang hydroelectric power station will be the second cascade station on the Da Xi, a tributary of the Ou Jiang, opposite to the major Jinshuitan hydropower station project. Shitang will be China's first unmanned hydropower station and will have upon completion an installed capacity of 78,000 kilowatts and produce 189 million kilowatt-hours of electricity a year. The bidding was conducted by the Provincial Electric Power Bureau and the East China Hydroelectric Construction Consulting Company of the Ministry of Water Resources and Electric Power. [Text] [Hangzhou ZHEJIANG RIBAO in Chinese 21 Nov 84 p 1]

JILIN POWER GENERATION EQUIPMENT--The third set of power generating equipment of the Baishan Hydropower Station, the largest in northeast China, went into trial operation on 8 December. Seventy-two hours of test running proved that power generating, transformation, distribution, and supply equipment, and other devices operated effectively. During the 72-hour test run, the generating equipment produced 11.67 million kWh of electricity for the power grid. By that time, the first-phase construction, covering three sets of generating equipment with a total installed capacity of 900,000 kilowatts, of the Baishan Hydropower Station had completed. [Summary] [Changchun Jilin Provincial Service in Mandarin 1030 GMT 13 Dec 84 SK]

CSO: 4013/66

## THERMAL POWER

### BRIEFS

JILIN TURBOGENERATOR--A 200,000-kW turbogenerating unit was installed in the Liaoning Qinghe power plant on 12 December. Together with this new generating unit, this power plant now has a total capacity of 1.3 million kW. China's largest thermal power plant, it will play an important role in easing power shortage in the northeastern region. [Summary] [Changchun Jilin Provincial Service in Mandarin 1030 GMT 15 Dec 84 SK]

JILIN POWER PLAN--On 18 December, Jilin Province held a work conference on building power plants, which adopted a power plant construction target which would double the number of power plants in the province during the Seventh Five-Year Plan period. The new construction and expansion projects of the Hunchun thermal power plant, the Changchun thermal power plant, the (Changshan) thermal power plant, and the Jilin thermal power plant will be carried out in 1985. After completing the building of these new projects, their installed capacity is expected to reach 1.4 million kilowatts and will double that of the existing thermal plants throughout the province. [Excerpt] [Changchun Jilin Provincial Service in Mandarin 2200 GMT 18 Dec 84 SK]

DATONG NO 2 AHEAD OF SCHEDULE--State Council Vice Ministers Wan Li and Li Peng recently sent a congratulatory telegram to the personnel involved in the construction of the Datong No 2 Power Plant on the completion of the No 2 generator some 4 months ahead of schedule. The Datong No 2 Power Plant is a key state construction project; it will have six generating units with an installed capacity of 200,000 kilowatts each. The No 1 generator became operational on 30 June 1984 and the No 2 generator joined the grid on 11 December 1984. [Excerpts] [Beijing RENMIN RIBAO in Chinese 28 Dec 84 p 1]

CSO: 4013/68

COAL

NEW POLICIES SAID TO IMPROVE COAL SUPPLY, LOWER PRICES

OW041212 Beijing XINHUA in English 1137 GMT 4 Jan 85

[Text] Beijing, 4 Jan (XINHUA)--Policies allowing coal mines to sell off part of their output after meeting state quotas has improved supplies to industrialized Shanghai and southern China, according to officials here.

Under the new policies implemented last year, the central government is no longer flooded with urgent cables for additional coal supply. Local authorities are now able to get coal on the open market by paying cash or bartering with other needed goods, the officials said.

Shanghai, China's leading industrial center, now has enough coal in stock to last its factories several weeks.

Coal supplies were formerly controlled by the central government.

With more coal available on the open market, the officials said, stocks in Jiangsu, Hubei, and Guangdong Provinces were 20 to 40 percent higher this winter.

The cost of fuel is also lower because the current policy allowed the price of beyond-quota coal to float with market demand.

Mines can retain part of the income gained from their open market sales to improve working conditions, reward outstanding workers and offer more benefits, officials said.

CSG: 4010/58

COAL

## HUBEI COAL PRODUCTION OUTSTRIPS QUOTAS

Wuhan HUBEI RIBAO in Chinese 4 Oct 84 p 1

[Article by He Jinkai [0149 6855 7030]

[Text] The Hubei Provincial Department of Coal Industry, enthusiastically cutting back on governmental controls, following comrade Hu Yaobang's directive to "let flow like water," has seen an increase in provincial coal production unmatched in many years. In the period from January to August, 4,020,000 tons of raw coal were produced, or 73.2 percent of that planned for the year. Three state-run coal mines in the province cut their operating losses by 3,640,000 yuan, or 110 percent of that planned for the year. The average cost per ton of coal fell 3.20 yuan. Workforce efficiency went up and shoring costs and electric costs were both reduced.

Beginning this year the party committee of the Provincial Department of Coal Industry, with the goal of rectifying the Party and stimulating the economy, divided up its membership into three investigation groups for in-depth, on-the-spot work and investigation at all coal mines across the province, and for determining ways to solve the problem of cutting back on government controls to effect a complete restructuring, to make sure more is got out of old mines and new mines are built faster, promulgating the "let flow like water" line in all plans and areas. Because the contract-responsibility method was put into effect for material production costs per ton of coal, the loss column got progressively smaller. Because coal mines were allowed to replace single-product management with economic diversification, comprehensive utilization was found for surplus labor, machine repair capabilities, motor vehicle transport, and discarded gangue coal. Coal mine activity was increased, raising production and income. At the same time the Provincial Department of Coal Industry was revising its thoughts on provincial monopolization of coal mines, and enthusiastically supported the development of township and commune-member operated coal mines, with marked effect. According to incomplete data, 1,800,000 tons of coal were mined by township enterprises, or 70 percent of that mined by state-run mines. This is also something previously unheard of!

12263

CSO: 4013/18

## COAL

### USSR, FRG, U.S. INVOLVED IN DEVELOPMENT OF BIG CHINESE COAL FIELDS

HK200251 Hong Kong TA KUNG PAI in English 20 Dec 84 p 4

[Text] Construction of five big opencut coalfields, jointly designed by China, the U.S., West Germany, and the Soviet Union, are in full swing. They are: Huolinhe and Yiminhe coalfields in Inner Mongolia, Junggar coalfield in Xinjiang, Yuanbaoshan coalfield in Liaoning Province, and Pingshuo coalfield in Shanxi Province.

The initial cutting areas at Huolinhe and Yiminhe have already gone into production, the former producing 3 million tons of raw coal a year and the latter 1 million tons.

The opencast field at Pingshuo in Shanxi Province is stepping up its construction of a special railway, electricity, and water supply systems, coal dressing plants, repair shops and other facilities as well as living quarters for the staff and miners.

Feasibility studies of the Junggar and Yuanbaoshan coalfields have been completed, and designing and preparatory engineering work are being carried out.

The feasibility studies and designing are done by Chinese experts in association with foreign companies. The Yuanbaoshan coalfield is a joint undertaking between China and West Germany; Huolinhe, Yuanbaoshan, and Pingshuo are between China and the U.S.; and the Yiminhe coalfield is a cooperative venture between China and the Soviet Union.

Mining of Huolinhe, Yiminhe, Junggar, and Pingshuo coalfields will rely on heavy-duty dump trucks. The chief equipment at Yuanbaoshan coalfield are excavators, conveyor belts, and bulldozers. Large consignments of the equipment have been ordered from West Germany, the U.S., Japan, Sweden, Britain, and other countries.

According to statistics released by the Ministry of Coal Industry, China had produced 717.27 million tons of coal up to 13 December. This figure is 7 million tons more than the planned target set for 1984.

More than 342 millions tons, or 48 percent of the total, was produced by mines run by local authorities. The rest was produced by mines operated under the Ministry.

If all goes well, said a Ministry spokesman, the 1984 annual output could reach a record 760 million tons.

## COAL

1984 QUOTA MET; TOTAL OUTPUT MAY TOP 760 MILLION TONS

OWL131324 Beijing XINHUA in English 1259 GMT 13 Dec 84

[Text] Beijing, 13 Dec (XINHUA)--China has produced 717.27 million tons of coal, overfulfilling its 1984 annual output quota, the Ministry of Coal Industry announced today.

The figure, tabulated up to today, was 7 million tons over the planned target and up 9.5 percent over the same period of last year.

More than 342 million tons, or 48 percent of the total, was produced by mines run by local authorities, and the rest by mines operating under the ministry.

If all goes well, said a ministry spokesman, the 1984 annual output could reach a record 760 million tons.

New mines put into operation so far this year have a combined yearly production capacity of 9.78 million tons, he said, and the added annual capacity will have reached 13 million tons by 31 December.

Per-capita productivity and other major economic and technical norms were "all-time highs" in the first 10 months of this year.

CSO: 4010/50

COAL

# PROPOSED CONTRACT SYSTEM WOULD GREATLY BOOST OUTPUT OF MAJOR MINES

OW191200 Beijing XINHUA in English 1149 GMT 19 Nov 84

[Text] Tangshan, 19 Nov (XINHUA)--A contract system is to be introduced for the 1985-1990 period in China's major coal mines.

All the Coal Ministry's major mines will be responsible for output increases, mine construction and investment, as well as profits and losses.

Gao Yangwen, Chinese minister of coal industry, announced this move at a national conference on coal industry now in session in Tangshan, north-east of the port city of Tianjin.

The move is designed to make these major mines produce 500 million tons of coal by the year 1990 and 1.2 billion tons by the year 2000.

These major coal mines are expected to cut more than 385 million tons of coal this year, and under the contract system they will ensure an annual average increase of 20 million tons on the basis of 1984 output, said Minister Gao.

Mines under construction by the year 1990, the minister said, will be having an aggregate production capacity of 180 million tons and new mines with a combined production capacity of 160 million tons will have been built and put into operation by then.

Planned investment in these coal mine projects will be 31.5 billion yuan in the 1986-1990 period. They will not be helped out if they overspend and will keep any surplus.

They will also be accountable for annual state allowances of 300 million yuan.

CSO: 4010/38

## COAL

### DEMAND FOR COAL GAS OUTSTRIPS SUPPLY

Shengyang LIAONING RIBAO in Chinese 30 Sep 84 p 2

[Article by Hong Xiuwen [3163 4423 7186]]

[Text] Since the Revolution, the coal gas industry in Liaoning has had rapid progress. The daily supply of synthetic coal gas and natural gas today is 12 times of that in 1952. The supply of liquefied petroleum gas has also expanded from a 100-household experiment to 300,000 households in 8 cities. The supply of gas in the cities has reached 41 percent--more than twice the national average for gas supply in urban areas--but still falls far short of the needs of urban development and people's need. Today, there are hundreds of thousands of residents wishing to be freed from the use of coal and firewood. The textile, glass and medicine industries need more and more gas and cannot get it. On the other hand, because of the irrational use, there is considerable waste.

The loss and waste of gas show up in three areas. First, the loss through leakage is high. The leakage loss is generally more than 10 percent and can be as high as 20 percent. In 1983, the seven gas companies in Liaoning Province lost a total of 28 million cubic meters of synthetic coal gas and natural gas, enough to supply 60,000 residents for a whole year. Second, boilers are not standardized and no attention is given to their performance and efficiency. There are dozens of different varieties of boilers and the average thermal efficiency is less than 50 percent. This not only leads to great losses of gas but also pollutes the atmosphere and threatens human health. Third, the low price of gas also aggravates the loss and in some cases coal gas is even used for heating the room. These are strong evidences that the potential for conservation is great and should receive the proper attention. Therefore, we make the following recommendations:

1. The role and leadership of the coal gas conservation office should be strengthened and the regulations should be made more complete. Although coal gas conservation offices were established in some cities in the past, they did not receive the proper attention by the leadership and became rubber stamps. The function of the gas conservation office must

be fully developed to lead the conservation effort, establish regulations, promote the cause, educate users, and raise the awareness of the gas users so that they are interested in conservation and know how to conserve.

2. Use leakage loss as the main criterion in evaluating the coal gas companies. Any organizations that have unacceptably high leakage loss will not be given the designation of progressive unit or enterprise. For individual users, the supply of coal gas will be handled in a manner similar to the water supply. The supply will be quantified and the price will be higher for usage exceeding a fixed amount. Economic measures will be used to promote conservation and curb waste.

3. Coal gas burner inspection centers should be established to periodically inspect and evaluate industrial and residential coal gas burners. High performance, high efficiency, and economical burners will be chosen and their use will be promoted throughout the province. Other unacceptable burners will be limited in its use and gradually phased out. The average thermal efficiency of the burners will be increased from 50 percent to 60 percent. Through the improved efficiency alone, 140,000 cubic meters of coal gas will be saved in the cities of Liaoning and 100,000 household users can be added. If the liquefied gas furnaces can be standardized, more than 5000 tons of liquefied petroleum gas will be conserved per year and 28,000 more users can be supplied with gas.

4. The pricing policy should adhere to a rational pricing system based on the quality. The current gas price is too low, especially in Anshan, Benxi, and Fushun. For example, a medium size family uses 4-5 yuan of coal per month in Shengyang and Dalian, or 2-3 yuan of coal gas. In Anshan, Fushun, and Benxi, it costs only slightly more than 1 yuan. This price difference not only violates the principle of value and hampers the development of gas resources, but also causes serious waste in gas usage. The price should be raised and this irrational price situation should be rectified as soon as possible. In view of the financial condition of the workers, the price of the base amount in civilian use should not be adjusted before wage adjustment but the usage in excess of the base amount should be charged at a higher rate. The principle of value must be adhered to in the promotion of coal conservation.

9698

CSO: 4013/27

COAL

HUAINAN'S XIEYI MINE DOUBLES OUTPUT WITH MODEST INVESTMENT

Beijing RENMIN RIBAO in Chinese 13 Oct 84 p 1

[Article by Yao Yangguo [1202 3601 2047] and Ma Changqing [7456 1603 7230]: "Xieyi Coal Mine in Huainan Doubles Production "]

[Text] The Xieyi coal mine in Huainan found a way to reap big returns with small investment through technological improvements.

The Xieyi coal mine is a 30-year-old mine with a designed production capacity of 900,000 tons per year. In 1983, this mine produced 2,040,000 tons and performed as two mines of its size. In the first 9 months of 1984, it had already produced 1,440,000 tons of raw coal. Since the Third Plenum of the Eleventh Party Central Committee, Xieyi mine has completed eight economical and technological projects and the production has increased at an average rate of 100,000 tons per year for the last 6 years. Mine director Liu Mingshan [0491 2494 0810] gave the following account. To build a new mine with a 900,000-tons capacity, it would take 150 million yuan of investment and 5-6 years and it would be at least 2-3 years after completion before the designed production level could be reached. But the Xieyi mine doubled its production through modification and technological improvement and used only 40 million yuan.

The Xieyi mine pioneered the practice of doubling the production through technological improvement. They mobilized the initiativeness of the staff and the workers by improving the wage distribution, reward system, operating system, cadre management, and mining regulation. As a result, they reduced manpower by 25 percent and raised the production level by 20 percent.

Striving for technological improvement is the key to the success of the Xieyi mine. In the last few years, production growth has benefited from the installation of ventillation, drainage, electrical supply, and coal hoisting systems.

Another means to achieve high production is to bring along the small mine shafts with the large mine shafts. In 1981, they organized 2000 unemployed youths to go down into the main shafts for residual coal. In the last 2 years the small mine shafts have provided 380,000 tons of quality coal for local industry.

9698

CSO: 4013/27

COAL

## SHANXI NOW PRODUCING ALMOST ONE-FOURTH OF TOTAL NATIONAL OUTPUT

OW111739 Beijing XINHUA in English 1635 GMT 11 Dec 84

[Text] Taiyuan, 11 Dec (XINHUA)--Shanxi, China's leading coal producing province, is expected to produce 180 million tons this year, 24 percent of the nation's annual output.

By the end of November, it had produced 165 million tons, meeting the target planned for 1985, the last year of the Sixth 5-Year Plan period.

Central authorities are giving top priority to Shanxi in the allocation of funds and materials to develop it into a national energy and coal and chemical industrial base.

Since 1979, officials said, the province has imported more than 100 complete sets of extraction and tunneling equipment.

As a result, more than 70 percent of the operations in coal mines operating under the Ministry of Coal Industry are now mechanized.

Two pairs of new shafts have been put into operation since the beginning of this year, and work has been finished on the expansion of five other pairs. This has added 7.44 million tons of yearly production capacity.

Thirty pairs of coal shafts are being built or expanded, officials said. These will have a combined annual production capacity of 37.84 million tons.

More than 2,600 coal mines in Shanxi are run by rural collectives and another 270 by authorities below the provincial level. These will produce at least 100 million tons this year, officials said.

Of the six railways linking Shanxi with other parts of China, five are being transformed into electrified, double-track railways to increase outgoing transport of coal. Transformation of the other--the Taiyuan-Shijiazhuang Railway--was finished in September 1983.

A new railway line specially designed for heavier coal trains is being built to link Datong, a leading coal center in Shanxi, with Qinhuangdao, an important coal harbor.

Insufficient transport has been a major hindrance to the development of coal production in Shanxi, officials said. This problem will be solved by 1990, they estimated.

## COAL

### DEEPENING, RECONSTRUCTION, AND EXPANSION KEEP MINES PRODUCING

Beijing MEITAN KEXUE JISHU [COAL SCIENCE AND TECHNOLOGY] in Chinese No 9,  
Sep 84 pp 2-6

[Article by Sun Zhongzheng [1327 0022 6966] of the Xuzhou Mining Administration: "Deepening, Reconstruction, and Expansion of Collieries"]

[Text] Horizontal deepening of the collieries is a necessary technique to renew coal mines and keep them producing at a steady and high level. Reconstruction and expansion are important means to develop the coal production.

From 1953 to 1982, the Xuzhou Mining Administration produced about 200 million tons of raw coal. Except for the four pairs of new mines built in western Xuzhou, most of the production came from the deepening, reconstruction, and expansion of existing coal mines. In recent years, the production development at the Xuzhou Mining Administration has been relatively fast; by deepening and expanding the existing mine shafts and by building four pairs of new mine shafts in the west, the designed total annual production for 1981 has reached 8 million tons. After the completion of the expansions of mine shafts at Qishan, Jiahe, Zhangji, and Quantai, the annual production will exceed 10 million tons. After the deepening, reconstruction, and expansion, the annual yield per mine shaft has increased from 450,000 tons to 0.9-1.5 million tons.

#### I. Features in Mine Shaft Deepening

##### 1. Combine deepening with reconstruction and expansion

Among the mine shafts in Xuzhou Mining Administration, 87 percent of the shafts have been deepened, with the exception of the two mines in Zhangji and Tuochang. Mines at Dahuangshan and Quantai are producing at the third level, and the deepening of the third level of the Qishan mine is currently underway. Since the deep reserves of the coal mines have now been explored, the scope of mining has also been expanded appropriately. In order to develop the potential of the mining facilities, the deepening is combined with the reconstruction and the expansion, see Table 1.

Table 1. Deepening and Reconstruction of Mine Shafts in Xuzhou Mining Administration

Name	Designed Capacity (10 <sup>4</sup> ton/yr)	Deepening elevation (m)	Step height (m)	Deepening and reconstruction modes	Coal seam	Horizontal reserve (10 <sup>4</sup> tons)	Total construction (m)	Investment (10 <sup>4</sup> yuan)	Max. yield (10 <sup>4</sup> ton/yr)
Xiaqiaojin	45	-270	90	New construction of main and auxiliary shafts	Taiyuan	933.4	10,657	1043.0	67.4
Dahuangshan	90	-320	200	Direct deepening of main and auxiliary shafts	Shihezi	1500.0	6,144	937.0	140
	90	-500	180	Belt dip heading and staple shaft	Shihezi	1300.0	5,539	1162.8	160.3
Quantai	45	-330	180	Direct deepening of main and auxiliary shafts	Shihezi	731.0	6,245	621.5	93.5
	120	-600	270	Build new mixed shaft, build new belt dip heading	Shihezi	2495.7	12,246	3550.8	117.6
Qishan	60	-420	200	Build new main shaft, build staple shaft	Shihezi	1984.9	3,607	754.9	138.4
	150	-700	280	Build new auxiliary shaft, build belt dip heading	Shihezi	3565.6	19,648	7674.0	
Dongzhuang	45	-420	220	Build new mixed shaft	Shihezi	724.2	4,592	1344.3	72.8
Xinghe	30	-260	140	Deepening main shaft, build rail dip heading	Shihezi, Taiyuan	1013.0	6,324	619.5	41.2
Jiahe	120	-600	320	Build new auxiliary shaft, build belt dip heading	Shihezi, Shanxi	3407.8	14,945	7631.4	
Pangzhuang	120	-378.5	208.5	Build new auxiliary shaft, build belt dip heading	Shanxi	1824.6	14,067	4358.8	136
Dongcheng	45	-220	80	Expand main shaft to -140m level	Shanxi	955.3	-	172.5	99
Zhangxiaolou	45	-600	200	Build new belt and rail dip heading	Shanxi	1151.1	6,570	1108.7	48.3
Yian	60	-500	220	Build new belt in staple shaft and auxiliary shaft	Shihezi, Shanxi	1165.0	16,853	3185.0	

## 2. Simultaneous improvement of the main shaft and the auxiliary shaft

The designed yield of the shallow section of most mine shafts in the Xuzhou Mining Administration is 450,000 ton/yr. After expansions made in the 1970's, the yield has increased to 800,000-900,000 ton/yr. Since the shaft cross-section and hoist capacity fell far below the application need, the main hoist system was reconstructed. At Quantai and Tiahe, the bucket size was enlarged and the elevator speed was increased. A new main shaft was built at the second level of the Qishan mine shaft. Along with the use of combines and the deepening of main shafts, the main shafts and the auxiliary shafts were reconstructed at the same time. A new mixed shaft was built at the third level of the Quantai mine shaft. New large cross-section auxiliary shafts were built and existing main and auxiliary shafts modified at the second level of Pangzhuang and Jiahe and at the third level of Qishan.

## 3. Increase the vertical height

The height of the first level is usually 100 m, which is not adequate in the production improvement effort and should be increased to 180-280 m in the future. At Jiahe mine, an auxiliary level was built at -450 m and the vertical height of the second level has reached 320 m.

## 4. Frequent deepenings

For many years the activity at the Xuzhou Mining Administration has been limited to single seam mining, the mining is active but the horizontal reserve is limited. The designed capacity at Quantai, Qishan, Pangzhuang and Jiahe has been exceeded by 100 to 150 percent and deepening is required every 5 years or so. Every year there are four pairs of shafts undergoing deepening and such frequent reconstruction interferes with production.

## 5. Build new belt dip headings

As the mine shaft is deepened more and more, the ground temperature and pressure increases and the amount of gas also increases considerably. As a result, the existing production system can no longer meet the needs of the reconstruction. Therefore, in addition to modifying the existing shaft, new belt dip headings were constructed in Pangzhuang, Qishan, Jiahe and Yian.

## II. Lift Between Levels

Since the mines are practicing single seam mining, the increase in exploitable reserve for every additional meter of lift is only 32,900-127,300 tons. Most mines have a lift of 180-280 m. The lift between levels based on the minimum service life of a coal mine dictated by the code and the designed production level is 150 m for medium size mines and 200-280 m for mine shafts producing 900,000 tons/year or more. Even at this lift the service life still cannot meet the minimum code requirement, as shown in Table 2.

In the actual production most mine shafts operating at a production level that exceeds the designed level are using some dip heading coal to alleviate the

Table 2. Relationship Between Lift and Service Life

Name	Level	Length (m)	Reserve per meter of deepening (10 <sup>4</sup> tons)	Lift (m)	Service life (yr) per design capacity	Service life (yr) per increased production	Code requirement Service life (yr)	Lift (m)
Xiaqiao	-270	4,600	10.37	90	15.95	8.46	15	90
Dahuangshan	-320	6,000	7.5	200	11.9	6.8	20	336
	-500	6,000	7.22	180	10.32	5.9	20	349
Quantai	-330	5,200	4.08	180	11.6	6.63	15	232
	-600	5,200	9.24	270	14.8	8.49	20	365
Qishan	-420	6,400	9.92	200	23.62	13.5	20	170
	-700	6,400	12.72	280	16.9	9.7	20	331
Dongzhuang	-420	6,200	3.29	220	11.5	6.57	15	287
Xinghe	-260	6,400	6.75	150	24.1	13.78	15	94
Jiahe	-600	5,500	10.65	320	20.3	11.59	20	320
Pangzhuang	-378.5	3,200	8.75	208.5	10.9	6.2	20	364
Dongcheng	-220	3,600	11.94	80	15.2	8.66	15	80
Zhangxiaolou	-600	1,700	5.76	200	18.3	10.44	15	164
Yian	-500	4,000	5.30	220	13.83	7.93	15	238

shortage in the horizontal mining. Under such conditions the current lift cannot satisfy the needs in production development. In order to increase the horizontal reserve, to satisfy large-scale production increases and to maintain the service lifetime, the lift should be about 300 m.

### III. Deepening and Reconstruction Modes

#### 1. Make use of the existing shafts

If the existing shaft can be deepened and if the hoist ability can satisfy the deepened shaft, the original shaft should be made use of. Examples are the deepening of the second level at Dahuangshan and Quantai.

#### 2. Build new main shaft and auxiliary staple shaft hoist

The production of the second level at Qishan mine was increased from 450,000 tons/yr to 600,000 tons/yr. The existing shaft could not be deepened, so a new main shaft was built and a staple shaft was built from the old level to the new level and, together with the old auxiliary shaft, constituted a new auxiliary hoist system.

### 3. Staple shaft deepening

The mining at the third level of Dahuangshan is at a great depth and the existing shaft cannot be deepened. To maintain the original production level, the main hoist is a belt dip header and the auxiliary hoist is a staple shaft.

### 4. Build new mixed shaft

As the mine shaft depth increases, the mining field and the seam reserve both increase. The production level can be improved through reconstruction and expansion. However, if the original shaft cannot be deepened, then new mixed shafts may be built to mine the coal at a large depth. The third level of Quantai was developed in this manner.

### 5. Build new auxiliary shaft and belt dip headings

The second levels of Pangzhuang and Jiahe and the third level of Qishan have large coal reserves but the auxiliary shaft diameter was too small to take coal combines. The solution is to build a new large-diameter auxiliary shaft and reconstruction the original shaft. A new belt dip heading may be built toward the new level for hoisting the coal.

## IV. Comparison of Two Deepening and Expansion Methods

The deepening method of the second level of Quantai mine was a direct deepening to -330 m based on the original main and auxiliary shafts. After the third level (-600m) reconstruction and expansion, the annual production was increased from 450,000 tons/yr to 1.2 million tons/yr. The reconstruction method was to build a 7.7 m net diameter mixed shaft 500 m from the main shaft. The original main hoist and the newly built -300m to -600m belt then became the two hoisting systems of the mine. The original auxiliary hoist and the -330m to -600m central track between the original auxiliary shaft and the new shaft then became the two auxiliary hoisting systems of this mine.

After reconstruction and expansion of the -378.5m second level of the Pangzhuang mine, the annual production level became 1.2 million tons. The method of deepening and reconstruction is to build a 6.5m net diameter new auxiliary shaft at a location 225m from the original auxiliary shaft to serve as an auxiliary hoist. The original main shaft and auxiliary shaft (modified into the main hoist) and the newly built -170m to -387.5m belt system serve to hoist the coal for the whole mine.

### 1. Comparison of the construction volume

Table 3 shows that the Quantai proposal has an additional 942m of colleries construction and 29,505 m<sup>3</sup> of rock excavation than the Pangzhuang proposal. Converted to the construction per meter of deepening, the Quantai plan exceeds the Pangzhuang plan by 0.8m and 53.8 m.<sup>3</sup>

Table 3. Comparison of the Construction Volume

Item	Quantai	Pangzhuang	Difference
Main hoist (m)	2,269	2,025	+ 244
(m <sup>3</sup> )	64,432	30,965	+ 33,467
Auxiliary hoist (m)	1,138	435	+ 698
(m <sup>3</sup> )	15,818	19,780	- 3,962
Total (m)	3,402	2,460	+ 942
(m <sup>3</sup> )	80,250	50,745	+ 29,505
per 1m of deepening (m)	12.6	11.8	+ 0.8
(m <sup>3</sup> )	297.2	243.4	+ 53.8

## 2. Comparison of technical operation and management

The Quantai third level has two systems for the main hoist and for the auxiliary hoist. A -330m and -660m dip heading was added to the original shaft. Both the main hoist and the auxiliary hoist have two sections. Since the original main shaft is 500m from the newly built mixed shaft, the production systems on the ground are separated in two places. At the second level of Pangzhuang, the main hoist system and the auxiliary hoist system are combined into one. The main hoist system consists of the original auxiliary shaft and the -170 to -378.5m dip header. As a result, the two horizontal production systems of Pangzhuang are simpler and easier to manage. Less equipments were occupied by the main/auxiliary hoist system and the production cost is lower, as shown in Table 4.

## 3. Utilization of original equipment and facility

Both the Quantai plan and the Pangzhuang plan are deepening, reconstruction, and expansion schemes based on the same shaft performance and the same main and auxiliary facilities. Although both make use of the existing shaft and most of the existing equipments, the Pangzhuang plan makes better use of the existing facility. In the case of the Quantai mine, the new construction of the mixed shaft must be augmented by modifying some existing main shaft and equipment.

## 4. Production safety

The new construction of a mixed shaft at the third level of the Quantai mine was equipped with a pair of buckets and a pair of cages and the shaft will also double as a ventilation shaft. The two sets of hoisting containers interfered with each other in the hoisting process and the two sets of hoists must be both shut down for the maintenance and repair of equipment in the shaft and at the bottom of the shaft. In the hoisting process, rocks coal

Table 4. Comparison of the Main Hoist and the Auxiliary Hoist System Power  
(in kilowatts)

Item	Quantai	Pangzhuang	Difference
Original main shaft hoist motor	800	300	
Mixed shaft main hoist motor	2 x 800	-	
Newly built belt system motor	2 x 380	2 x 215	
Original auxiliary shaft (modified into the main hoist) hoist motor	-	630	
Original auxiliary shaft hoist motor	320	-	
Mixed shaft auxiliary shaft motor	570	-	
Newly built central track hoist motor	160	-	
New auxiliary shaft hoist motor	-	800	
Total	4,210	2,455	+ 1,755
Power per 1m lift	6.67	5.88	+ 0.79

and other articles falling out of one hoist and into the shaft hampered the operation of the other hoist.

The above comparison shows that the deepening method used at the second level of the Pangzhuang mine was better than that at the third level of the Quantai mine.

## V. Discussion

1. By reconstructing and expanding 6 pairs of mine shafts, the Xuzhou Mining Administration has invested 273 million yuan (71.16 yuan per ton) and obtained a net increase in annual production of 3.84 million tons. Compared with the 120-150 yuan/ton of new mine investment (Table 5), the Administration has saved 48.84-78.84 yuan per ton of coal produced. The economic efficiency in raising production level by modifying and expanding existing mines is therefore very good.

2. The reconstruction and expansion of the mine shafts were implemented without affecting the normal process of the deepening engineering or the production activity. Before the third level of the Qishan mine was put into production, the -700m horizontal belt dip heading was put into service ahead of schedule.

3. To meet the needs of improved production, the Xuzhou Mining Administration should suitably increase the lift between the levels to 270-320m. This would not only guarantee the service lifetime of the mine and a stable and high production level, it would also reduce the frequency of the deepening operation and improve the standard of the equipments and the management level.

Table 5. Investment and Production Increase for the Six Pairs of Reconstructed Mine Shafts

Name	Original designed production (10 <sup>4</sup> tons)	Production after expansion (10 <sup>4</sup> tons)	Net gain (10 <sup>4</sup> tons)	Investment (10 <sup>4</sup> yuan)
Quantai	45	120	75	3,550.8
Qishan	45	150	105	8,428.9
Jiahe	45	120	75	7,631.4
Pangzhuang	45	120	75	4,358.8
Dongchengjin	21	45	24	172.5
Yian	30	60	30	3,185.0
Total			384	27,327.1

4. Based on the experience of the Xuzhou Mining Administration in modifying 450,000 tons/yr coal mines into 0.9-1.5 million tons/yr mines, the preferred method is to construct new auxiliary shafts and build new belt dip headings toward the new level using the original main and auxiliary shafts.

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CSO: 4013/30

## COAL

### SYMPOSIUM ON COAL LIQUEFACTION HELD

Beijing MEITAN XUEBAO [JOURNAL OF CHINA COAL SOCIETY] in Chinese No 2, Jun 84, p 80

[Article by Zhang Zishao [1728 5261 0508]: "Scientific Symposium on Coal Liquefaction"]

[Text] The Coal Chemistry Committee of the China Coal Society held the First Symposium on Coal Liquefaction, from 26 February to 1 March 1984 in Beijing, and concurrently held the Second Coordinated Problem-Solving Session on the Technology of Direct Liquefaction of Coal. A total of 72 persons from 31 units nationwide attended the symposium. Comrade Wang Yanren [3076 3348 0086], permanent board member of the Coal Society and chairman of the Coal Chemistry Committee, delivered the opening remarks. Comrade He Bingzhang [6320 3521 4545], board chairman of the Coal Society, also addressed the symposium. The symposium received 41 papers. Developments in domestic coal liquefaction research and foreign trends of the last few years were covered extensively. The section on direct liquefaction of coal at the problem-solving session reviewed the work of the last year and set out the tasks for 1984.

The joint Sino-Japanese small-scale liquefaction continuous testing device built at the Beijing Institute of Coal Chemistry of the Coal Academy obtained good experimental results on liquefaction performance at the Beisu mine in Yanzhou. The Anshan Institute of Thermal Energy ran tests on an ASC small-scale industrial liquefaction testing device which was designed, processed and installed by the institute itself, mastered the technique of continuous hydrogenation liquefaction, and amassed experience in engineering and design. Studies by the North China Chemical Engineering College using pressure cookers for hydrogenation liquefaction of some younger bituminous coals and older lignites of China, showed that tetrahydronaphthalene is a relatively ideal solvent and the results are better than either decrystallized anthracene oil or  $\alpha$ -methyl naphthalene. The Beijing Institute of Coal Chemistry, using an American pressure cooker for appraisal tests of coal types, found that the liquefaction properties of jet coal from Haizhou in Fuxin and gas coal from Beisu in Yanzhou are quite good. Tests of Yanzhou and Gansu bituminous coals in the mini-pressure cooker at Taiyuan Engineering College showed a definite interrelationship of the initial hydrogen pressure, reaction temperature and reaction time with the conversion rate, and were convincing that there are many advantages to using the mini-pressure cooker for initial selection and evaluation of coal types.

The technology of coal liquefaction and quality of the product bears closely on the selection of the catalyst. As seen from the papers, we have also made some progress in this area. The East China Chemical Engineering College introduced various iron series catalysts to Yanzhou and Yilan coals. The results of liquefaction showed that catalysts of Hainan Dao iron ores are the most effective and that Ni-Mo catalysts in tetrahydronaphthalene solvents are about the same. Studies by the Shandong Mining College on red clay from the Shandong Aluminum Plant show that it plays an obvious role in increasing the formation of the liquefaction oil. Tests by the Beijing Institute of Coal Chemistry using a petroleum-series Co-Mo-Ni catalyst for hydrotreating of liquefaction products, found that the dehydrogenation results of this domestically produced catalyst are good and after prevulcanization tests, the activation is 15-20 percent higher. Beijing University, using methods such as electron energy spectroscopy, Fourier transform infrared, and dynamic pyridine heat-of-adsorption quantitative analysis to study catalysts such as Ni-Mo and Co-Mo series, made progress for theory and also sought out coal liquefaction catalysts from model chemical compounds.

Analytical monitoring during the process of coal liquefaction and chemical analysis of the liquefaction products are an essential part of coal liquefaction research. At present we have already set up large-scale analytical instruments and methods such as gas and liquid chromatography, infrared spectroscopy, and nuclear magnetic resonance. Instruments and methods for measuring molecular weight, viscosity, and carbon-hydrogen-nitrogen traces have also come to play a role. We can determine the degree of volatilization of liquefaction products by positive and negative liquid chromatography. We can identify the major components of the solvent and distillate oil in the liquefaction process by capillary gas chromatography. The Beijing Institute of Coal Chemistry improved on a method proposed by the Pittsburgh Energy Sources Center in the United States to identify asphaltenes, eliminating the factors affecting the accuracy of the results. Using the Sigma 10B microprocessor in monitoring and analyzing the gas produced in coal liquefaction greatly sped up the analysis.

Besides presenting foreign investigations and comrades who have conducted research and advanced studies in coal liquefaction abroad, the symposium also reported their research findings. These research findings will give impetus to the thorough development of research on reaction mechanisms in coal liquefaction in the future.

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CSO: 4013/219

## COAL

### BRIEFS

SHANXI COAL PRODUCTION--By the end of November, Shanxi Province had produced 165 million tons of coal, exceeding the annual target by 11.3 million tons and creating a new record. It is estimated that the province can produce more than 180 million tons of coal this year, exceeding last year's figure by 22.4 million tons, or 14 percent. [Excerpt] [Taiyuan SHANXI RIBAO in Chinese 10 Dec 84 p 1 SK]

SHANDONG RAW COAL OUTPUT--As of 14 December, Shandong Province has turned out 42.7 million tons of raw coal and prefulfilled its annual production plan by 17 days. Of this output, more than 10 million tons of coal were produced by collieries run by local units. [Excerpts] [Jinan Shandong Provincial Service in Mandarin 2300 GMT 14 Dec 84 SK]

EXPANDED MINE CAPACITY--Beijing, 31 Dec (XINHUA)--China has developed or expanded 21 major coal mines to add a record production capacity of more than 17.9 million tons, Coal Ministry officials said here today. The new or expanded mines with annual production capacities of over 1 million tons including the second phase of the Pingdingshan No 8 Mine in Henan Province; the Xiqu Mine in the Gujiao mining area in Shanxi Province; Nanlutian in the Huolinhe mining area and the first zone of the No 1 opencut mine at Yiminhe in Inner Mongolia, the Xiaoqing Mine of the Tiefa coalfield in Liaoning Province, and the Tucheng Mine in Guizhou Province. [Text] [Beijing XINHUA in English 1214 GMT 31 Dec 84 OW]

CSG. 4010/56

## OIL AND GAS

### NEW DEPOSITS FOUND AT DAQING

OW070744 Beijing XINHUA in English 0647 GMT 7 Jan 85

[Text] Daqing, 7 Jan (XINHUA)--New petroleum reserves estimated at 100 million tons have been found in Daqing, China's largest oilfield.

The discovery, made late last year, was the largest since Daqing went into operation in 1960, officials at the petroleum administration here said.

The oil deposits are located in the northern part of the Songhua-Liaohe River basin in Heilongjiang Province, northeast China, they added.

Daqing pumped a record 53.5 million tons of crude last year, 2.8 percent up on 1983, and accounted for half of China's total petroleum output.

More than 20,000 workers are now surveying nine areas in northeast China. Scientists expect to find new oil-bearing structures of considerable industrial value in the region.

Two of the 14 drilling teams involved in the surveys are American. There are also five seismic survey teams operating in an area near Daqing.

CSO: 4013/66

## OIL AND GAS

### PROSPECTS BRIGHT FOR LIAOHE'S ABUNDANT OIL

Shenyang LIAONING RIBAO in Chinese 21 Aug 84 p 1

[Article by Wang Houti [3769 0624 7555] and Zhao Yonghe [6392 3057 3109]:  
"Rich Oil Resources, Extremely Bright Prospects: A Visit With the Director  
of the Liaohe Petroleum Exploration Bureau, Zhou Yongkang"]

[Text] In recent years the prospecting and developmental work at the Liaohe oil field has progressed rapidly. The entire populace of the province has been following their work with keen attention. Where do they stand now? What are the prospects for development? We posed these questions to Zhou Yongkang [6650 3057 1660], director of the Liaohe petroleum exploration bureau.

The 43-year old Zhou is a member of Class 66 from the Beijing Petroleum Institute; he is well-versed in technical knowledge and also has bedrock work experience. Although he has been bureau director for only a year, he clearly displays leadership ability. When speaking of the production construction results at the Liaohe oil field, Zhou said: "In 17 years of exploration on the Liaohe oil field, we have drilled 3,723 wells; the total length drilled equals 8,620,000 meters; we have opened up 11 oil exploitation zones, and provided the nation with 44,590,000 tons of oil. More important, the oil field has grown up since those youthful years and is now a healthy teenager: in the last 2 years the annual oil production increase has been 1 million tons or nearly a million tons."

When asked of the development prospects for the Liaohe oil field, Zhou again answered, full of enthusiasm: "I can say that the prospects for the Liaohe oil field are exceptionally good. The area of the Liaohe oil field is 12,400 square kilometers; within it, the underground oil resource is very rich. Especially rich is the depression at the west end of the basin. Its oil and gas reserves rank with the best in the nation. In addition, the Fuxin, Zhangwu and Beili areas of Liaoning, as well as the Kailu, Chifeng and other areas in Inner Mongolia, are sedimentary basins, all of which may provide new territory for oil prospecting in the future. We have 2,300 square kilometers of shallow ocean area; this can serve as our strategic rear area. So there is a material base for the rapid development of the Liaohe oil field. Moreover, in the 11 oil zones already developed, most of them are just in their teenage years, so it is possible to guarantee

constant, high, production. We are assured that we can double the present oil production and known reserves by 1990, making a large contribution to the reconstruction of the people's economy. Just now we have concentrated seventeen derricks to wage a pitched battle of exploration at Shenyang's Damintun area. Next year we will put in over 100 producing wells, and we will construct surface storage and transport facilities. By 1986 the whole project will go into production with standard production capabilities."

Zhou added: "The speed-up of prospecting and development in the Liaohe oil field has relied and will rely on advances in science and technology. While paying close attention to updating old equipment and techniques, we will also pay close attention to pivotal projects, use our efforts to import up-to-date technology, techniques and equipment from abroad. We will also pay close attention to restructuring."

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CSO: 4013/18

## OIL AND GAS

### ECONOMIC REFORMS TAKE HOLD, DAQING PREFULFILLS 1984 QUOTAS

OW230620 Beijing XINHUA Domestic Service in Chinese 0030 GMT 20 Dec 84

[Excerpt] Harbin, 20 Dec (XINHUA)--China's leading oilfield, Daqing, has boosted its petroleum and petrochemical production by actively but steadily carrying out overall economic reform.

As of 19 December, the Daqing oilfield had fulfilled its 1984 state quota of 52 million tons of crude oil 10 days ahead of schedule. Major production targets including the output value of crude oil, commodity crude oil, commodity natural gas, oil exploration, drilling footage, seismic survey, and underground operations all topped peak years. The taxes and profits that the oilfield delivered to the state also increased somewhat over the corresponding period in 1983.

These gratifying changes in the Daqing oilfield are the great successes brought about by the reform of the economic structure.

In the past 2 years, Daqing oilfield has separated the government function from the enterprise function by officially setting up the Daqing City People's Government to take charge of culture, education, public health, grain, commerce, transportation, urban construction, and public security, which were formerly the oilfield's responsibilities. The Daqing Petroleum Administrative Bureau, the Daqing Petrochemical General Plant, and the Daqing Ethylene Engineering Headquarters became separate economic entities. This has relieved the petroleum and petrochemical enterprises of their social burden and enabled them to concentrate on oil exploration, development, production, and construction and to strengthen specialized management. The government and its functional departments have strengthened and improved administrative and management work in line with the principles and policies of the party and the state and have actively served the production and construction of petroleum and petrochemical products.

With the central task in mind of ensuring high, steady petroleum output and improving the economic results of petrochemical enterprises, Daqing oilfield this year has implemented or tried out, step by step, different forms of the system of contracted economic responsibility in accordance with the different characteristics of the enterprises. This system, which links a unit's and individual's economic interests with the degree of success in fulfilling their tasks, has effectively mobilized the workers' enthusiasm and greatly improved work efficiency.

## OIL AND GAS

### BEIJING TO SATISFY FUEL GAS NEEDS BY 1990

OW171636 Beijing XINHUA in English 1429 GMT 17 Dec 84

[Text] Beijing, 17 Dec (XINHUA)--All Beijing residents will be able to cook with gas by 1990, according to a city plan disclosed by Zhang Shengyuan, manager of the Beijing Gas Company here today.

Speaking at a national meeting on gas supply, Zhang Shengyuan said that of Beijing's 6 million metropolitan residents 146,000 households use piped coal gas, and 726,000 households cook with liquefied petroleum gas in cylinders. This leaves 590,000 households which use coal briquets.

"There has been a pressing demand for fuel gas," he said, "as more highrise buildings are going up and the tempo of life has been accelerated.

"The new 1-hour lunch break to be introduced next year is too short for people to cook a meal on a coal stove and eat it comfortably," he explained. The old system permitted people to have two hours break at noon for lunch and a nap. "Besides," he said, "reducing pollution is also one of our chief considerations."

To realize the goal of every family cooking with gas, Beijing municipality has made plans to expand Beijing coking plants for supplying coal gas to the whole city and to lay a 35-kilometer-long pipeline to transport natural gas from the north China oilfields to Beijing. By 1990, Beijing will get 5.3 million to 6.3 million cubic meters of gas supply daily. In addition, 150,000 tons of liquefied petroleum gas will be piped in every year. Thus, not only the needs of the residents of the city proper for cooking fuel will be satisfied, but also the fuel requirements for many factories will be ensured.

Zhang said his company will develop such devices as water heaters, ovens, automatic rice cookers and gas heaters to meet the new demands of the customers.

CSO: 4010/49

## OIL AND GAS

### OVER 20 PERCENT OF NATION'S URBAN HOUSEHOLDS NOW COOK WITH GAS

OW161310 Beijing XINHUA in English 1258 GMT 16 Dec 84

[Text] Beijing, 16 Dec (XINHUA)--The number of urban families using fuel gas doubled in the past 5 years, according to Chu Chuanheng, vice minister of urban construction and environmental protection.

Addressing the opening session of the first national meeting on urban gas supply here this morning, the vice minister attributed the increase to an additional supply of 3 billion cubic meters of gases of all kinds.

He said, by the end of 1983, 98, or one-third of China's cities, had gas facilities with a total supply of 7 billion cubic meters annually, 3 billion more than that of 1978. Twenty-one million urban residents, or 20.2 percent of the nation's total enjoyed the use of gas for cooking.

The state set up an energy conservation fund since 1980 for the recovery of waste gas of factories and mines, which was responsible for half of the additional supply in the past 5 years.

In the meantime, the development and utilization of natural gas and coal gas were also responsible for the rapid increase. Since 1979, the state has approved the construction of 15 large and medium sized gas projects to supply an additional 1.8 million urban households and some factories.

However, the vice minister stressed that China's fuel gas supply was still inadequate and great development was expected.

The 5-day meeting will discuss a development program and relevant technological and economic policies.

CSO: 4010/49

## OIL AND GAS

### USING SLAB STRUCTURE THEORY TO STUDY AND PREDICT LONG-RANGE PROSPECTS FOR SONGLIAO OIL AND GAS

Beijing SHIYOU XUEBAO [ACTA PETROLEI SINICA] in Chinese Vol 5, No 3 Jul 84  
pp 17-18

[Article by Cheng Shi [4453 4258]]

[Text] The use of slab structure theory to study the formation and evolution of intraslab basins and to explore slab structure and the laws of oil and gas production and distribution is an important topic which world petroleum structurists are currently researching. For the past 2 years the Petroleum Exploration and Development Institute has been using slab structure theory to study the evolutionary characteristics of the Songliao and other basins. The article "Study and Evaluation of Evolutionary Characteristics of Northeast China Oil- and Gas-Bearing Region Mesozoic and Cenozoic Huhou [1721 1775] Rift Valley Basins and Hushang [1721 0006] Sag Basins and Their Oil- and Gas-Bearing Prospects" (Zhang Kai [1728 1956], Gao Mingyuan [7559 2494 6678], and Yao Hui-jun [1202 1979 0689]), presented a new view, evaluating and predicting oil and gas prospects for the northeast by formation and providing a solid theoretical basis for expanding new areas for searching for oil.

The northeast oil- and gas-bearing area is south of the Yinshan-Yanshan magmatic curvilinear fault zone and borders on the North China oil- and gas-bearing area and is 1.6 million km<sup>2</sup> in area. Here there are 46 Mesozoic and Cenozoic oil- and gas-bearing basins of various types, with approximately 790 km<sup>2</sup> of depositional rock area, and approximately 3.36 million km<sup>3</sup> of depositional rock volume. These oil- and gas-bearing basins are distributed in a regular way in five structural zones: the Da Ninggan Ling-Inner Mongolia epicontinental magmatic arc expansion rise (such as Erlian and Hailar basins), huhou expansion depression (such as the Songliao Basin), epicontinental magmatic arc expansion rise (such as Boli and Jixi basins), arc-continental collision depression (such as Sanjiang Basin) and the Yinshan-Yanshan rise (such as Fuxin, Chaoyang basins).

Although the Songliao Basin, which was proven to contain abundant oil and gas, was prospected and developed for over 20 years, the extent of prospecting was rather low covering only a range of 260,000 km<sup>2</sup>. Currently there are only 0.67 km of seismic logs per km<sup>2</sup>, and only one well for every 272 km<sup>2</sup>. The Songliao Basin is a large congruent basin developed in the late Paleozoic and Mesozoic-Cenozoic on a plate that crystallized in the Precambrian.

During the Late Paleozoic, the Mesozoic and the Cenozoic, six different oil and gas bearing aggregations were formed. The oil and gas resources are unusually abundant, the prospective area of superpositioned oil and gas bearing formations totals 550,000 km<sup>2</sup> and the reserve prospecting area is also very extensive. During the Late Paleozoic it went through three evolutionary stages of huhou basin (C<sub>1-2</sub>), collision foreland basin (C<sub>3</sub>-P<sub>1</sub>), and collision premontaine basin (P<sub>2</sub>) and formed a Carboniferous-Permian stratus oil- and gas-bearing aggregation. Inferring that in the western part of the basin there is a C-P down-warped basin which is highly evolved and where it is possible to find natural gas resources and which may be the source of oil and gas in the Mesozoic and Cenozoic strata overlaying it. The prospective oil and gas bearing area is approximately 100,000 km<sup>2</sup>. During the Mesozoic, the eastern part of the Songliao Basin was influenced by epicontinental magmatic arc and was also controlled by thermal expansion and contraction of arching of matter on the earth's mantle. The basin underwent a shift in structural environment in the early and mid Triassic and in late Triassic the earth's crust pushed upwards, in the Jurassic there was the early sag of a dual huhou rift valley, which formed a deep coal series-volcanic rock oil bearing aggregation with prospective oil- and gas-bearing area of as much as 100,000 km<sup>2</sup>. In the early Cretaceous Dengloulou-Quantou depositional period it was an intermediate faulted-downward basin in a dual huhou rift valley, which formed a Mesozoic faulted-downwarped transitional riverine-lacustrine lower oil bearing aggregation with oil bearing prospect area of 103,000 km<sup>2</sup>. The Qingshankou-Nenjiang depositional period was an evolutionary period of stable sedimentation in a faulted-downwarped lake basin in a late dual huhou valley basin forming a faulted-downwarped lacustrine-riverine central oil bearing aggregation, with an oil bearing area of over 150,000 km<sup>2</sup>. The late Cretaceous was a shrinking and slow sedimentation stage of a faulted-downwarped lake basin in a terminal rift valley basin forming upper Cretaceous shallow oil bearing aggregation with shallow gas layers and may have water soluble natural gas resources. The Tertiary-Quaternary strata in the western part of the basin formed a large syncline overlapping the upper Cretaceous syncline and has been found to have abundant water resources and also may have resources of water soluble natural gas. Thus, the Songliao Basin is a large congruent basin which developed over a long period of time and its evolutionary characteristics formed an anticlinal oil and gas deposit with abundant oil and gas; at the same time, during the Mesozoic and Cenozoic evolutionary processes there were three large areas of overlapping sedimentation and two of re-treating sedimentation, the lake shoreline became larger, the sedimentational discontinuities were numerous, and combined with the fault system, not only provided the favorable channels and conditions for initial and secondary migration of oil and gas, but controlled by regional type covering strata, formed many non-anticlinal oil and gas deposits.

Due to the fact of the great influence on the physical nature of the deposits by being buried deeply and geothermal action, the deep deposits in the Songliao Basin changed became primarily fissures and induced pores. Inferring reservoirs of late Paleozoic oil bearing aggregations and Jurassic deep oil bearing aggregations, the primary pores were not numerous, and the fissures and induced pores predominated.

In addition to the Songliao Basin, the Erlian, Hailer, Mohe, Sunke-Sunwu, Sanjiang, and Hulin-Xinkai lakes also developed late Carboniferous-Permian, Jurassic, Cretaceous and some Tertiary marine, transitional marine-continental, and epicontinental deposits and are also congruent oil and gas bearing basins which formed many oil bearing aggregations in different periods.

Proceeding from the oil and gas bearing characteristics of the Northeast oil and gas bearing region and the Songliao Basin, to create a new situation in petroleum industry development, and to realize a steady annual increase in reserves, prospecting plans should stress replacement work in primary prospecting target strata and reserve prospecting target strata in basins; stress replacement work of anticlinal oil and gas deposit and non-anticlinal oil and gas deposit prospecting; stress replacement work of central portion petroleum resources prospecting and deep portion and shallow portion natural gas resources prospecting; stress replacement work of the Songliao Basin and peripheral oil and gas bearing basin prospecting.

Inferring from the geological characteristics of the Songliao Basin and the surrounding basins, it is possible that by the year 2000 an additional 2.5-3.0 billion tons of geological reserves may be discovered. For this reason, in prospecting work in the Songliao Basin, in Cretaceous stratigraphic sections where oil has already been found, finding non-anticlinal oil and gas deposits should be primary; in late Jurassic rift valleys in the east and in the northern and southern parts of the central rift valley zone, finding light oil and natural gas should be primary. In the southern, central and northern part of the basin, look for lower oil bearing aggregations, shallow oil strata, heavy oil, and deep natural gas. In the sloping zone in the west, late Paleozoic C-P systems should be the prospecting targets as well as to look for covered oil deposits in western Jurassic rift valleys and central oil bearing aggregations. At the same time, forces should be actively organized to carry out research on such basic conditions as structure, strata, oil bearing conditions and oil and gas traps in peripheral basins so as to facilitate the attack direction to choose the most likely basins and to make the selection as quickly as possible.

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CSO: 4013/228

## OIL AND GAS

### CARBONATE ROCK POOLS IN NORTH CHINA AND THEIR PRODUCTION FEATURES

Beijing SHIYOU XUEBAO [ACTA PETROLEI SINICA] in Chinese Vol 5, No 3, Jul 84  
pp 43-55

[Article by Bao Songzhang [2672 2647 4545], Geological Survey, North China Oil Field, and Wang Xue [3768 7185], Petroleum Exploration and Development Research Institute]

#### [Excerpts] Introduction

Development of north China carbonate rocks has been underway for over 7 years and with the development of oil field exploitation and intensification of research work, preliminary results show that the reservoir spaces in carbonate rock pools are not uniform in size and are complex in distribution. In basic form they are divided mainly into three types: fissure, pore, and cavity, or what may be called the three basic reservoir spaces. The three types of space mutually combine to form complex reservoir-vadose regions; there are always some combination relationships which dominate in each oil pool and there are great differences in the displacement mechanisms and the vadose characteristics of liquids in them. Clarifying the reservoir types and displacement mechanisms of carbonate rock pools, analyzing their production characteristics, and proposing corresponding technical measures are basic conditions for the rational exploitation of oil fields.

Geological research for developing carbonate rock pools is a very complex subject and there are definite limitations to existing results and knowledge. According to analysis of currently available materials, the carbonate rock pools in North China may be divided into three reservoir types, viz., fissure-solution cavity, porelike, and a pore-cavity-fissure combination. (Table 1)

[Table next page]

Table 1

Para- meters Class	Pore structure	Porosity (%)	Penetra- tion co- efficient (D)	Production pressure difference (atmos- pheres)	Pressure recovery curve recovery time	Crude oil under- ground viscosity (centi- poise)	Crude oil surface specific gravity	Oil ex- traction index tons/day- atmos- pheres	Move- ment coef- ficient md/cm	Repre- senta- tive oil pool type
I	fissure solution cavity type	6-8%	9.3-2.0	2	2-3 min	3.4	0.975	137-178	88-590	Rengiu Oil Field Ordo- vician oil pool
II	pore- like type	>10%	0.26	>15	2-10 min	4.9	0.854	16	53	Hejian Oil Field Gao- yuzhuang oil pool
III	pore- fissure cavity type	<6%	0.921-1.08	<10	<2 min	8.2-9.1	0.888	297-466	102-112	Rengiu Oil Field Wumi- shan oil pool

## I. Fissure-Solution Cavity Type Carbonate Rock Pools

The Majiagou, Ordovician rocks in the Renqiu Oil Field are primarily limestone, and marlite, limestone making up about 80 percent and dolomite making up about 20 percent, as a medium-to-thin stratum sandwiched in the middle of the limestone.

On the basis of geological logs and rock core analyses, fissures and solution cavities are the primary reservoir spaces. From observations of rock core from Ren 813 well, there are four kinds of oil-bearing occurrences: 1. fissure oil-bearing; 2. intercrystal pore and solution pore oil-bearing; 3. solution pore cavity oil bearing; 4. fault breccia oil-bearing. Of 119 oil-bearing limestone rock cores, 114 were fissure oil-bearing, or 95.8 percent.

The results of electron microscope scanning and thin slice observations show that the rock matrix pores are not developed, with pore diameters averaging less than 1 micron, and pore connections predominantly less than 0.1 micron; in 145 limestone slices with open fissures, the rock pores of only 7 samples saw blue organic glass; the capillary pressure curve of 40 limestone samples for mercury saturation at 150 atmospheres was 20-40 percent, the pore volume controlled by throat diameters of less than 0.1 microns was greater than 60 percent.

According to survey class comparison with the Ordovician at Zhoukoudian in Beijing, the pore distribution curve of this type of oil pool has single peak transformation characteristics, showing that large fissures and cavities are the primary reservoir spaces, the rock matrices are predominantly untramicropores, and actually it has no reservoir capability. According to the results of rock core analysis, unloading drop-out, and simulation analogies, the effective porosity of the Majiagou oil strata is 2.7 percent, its large fissure and cavity portion is 0.6 percent, rock matrix portion is 1.7 percent, medium and small fissures and cavity portion is about 0.4 percent.

In the process of drilling, unloading dropout occurred in nearly half of the wells but all occurred in the weathering solution belt. The pressure recovery curve is generally characterized by fast recovery, and small gradient (generally less than 1), production pressure difference is less than 2 atmospheres, extraction index is 100-200 tons/day.atmosphere, reflecting the dynamic features of fissure-solution cavity carbonate oil pools.

Laboratory tests prove that the wetting character of the oil strata is hydrophilic. Measurement studies of the relative penetration rate of oil and water have not yet been carried out, but one can refer to similar curves of fissure systems.

The results of fissure-solution cavity type water driven oil experiments show (Table 2):

[Table on next page]

Table 2 Results of Experiments on Fissure-Solution Cavity Water Driving

Type number	Water injection speed (ml/min)	Waterless less recovery rate (%)	Waterbearing period recovery rate (%)	Recovery rate with water injection double pore volume (%)	Notes
1-5	7.65	5.77	15.00	21.0	
1-6	6.23	5.80	10.10	13.1	
1-1	4.66	6.50	16.40	19.8	
1-4	3.66	7.90	13.73	12.3	
1-2	3.07	6.90	14.90	15.6	
1-3	1.20	10.58	8.60	19.2	

Type parameters Gross mass 1948 cm<sup>3</sup>, fissure width 0.3-0.6mm, fissure porosity 1.5 percent, rock mass pore volume 263 cm<sup>3</sup>, rock mass porosity 13.5 percent, bound water not taken into consideration

(1) The influence of water injection speed (corresponding to the oil extraction speed under field conditions) on the effectiveness of development, is manifested mainly in the waterless oil extraction period: when the water injection rate is high, the water appearance time is advanced, and the waterless recovery rate is low; conversely, when the water appearance time is retarded, the waterless recovery rate is increased. The relationship between the water injection rate and the water-bearing recovery rate and the ultimate water-driven recovery rate is not clear.

(2) Once water appears in an oil well, water bearing increases sharply until it enters the high water bearing period when there is a retardation in the sharp rate of increase in water bearing.

(3) The waterless recovery rate is rather low: the waterless recovery rate is 5.8-10.6 percent.

Preliminary analysis holds that the water-driven process of fissure-solution cavity type carbonate rock oil pools relies on driving pressure and gravitational action, which includes two processes occurring simultaneously: one is the flow of a liquid under pressure, and the other is the displacement of a fluid between fissure and solution-cavity by gravitational action. The efficiency of driving oil in this type of oil pool is mainly determined by the size of the ratio between fissures and cavities and the connections between fissures (and solution cavities). If the connections between the fissures and

the cavities is good, and if the ratio between the fissures and cavities is large, then the efficiency of oil driving will be high; otherwise, the efficiency of oil driving will be low. Poor connections between fissures and cavities and a small ratio of fissures and cavities in experimental models is an important reason for low rate of recovery.

Water injection development practice with Majiagou (Ordovician) oil pools in Renqiu Oil Field shows that the relationship between injection and extraction in this type of oil pool is very clear. For example, water was injected into Ren 88 well and 5 days later showed results in Ren 801 well 560 m. distant: wellhead pressure had risen 2.3 atmospheres, and after 6 days, showed results at Ren 81 well, 1,560 m distant, where wellhead pressure rose 1.5 atmospheres. When an oil pool first goes into production, because the output is very high and not enough water is injected, within a half year, the stratus pressure drops 65.3 atmospheres; afterwards, the volume of water injection increased, and within half a year, the stratum pressure had risen 7.2 atmospheres, but because the volume of water injected in the top portion was too high, the comprehensive water-bearing speed rose to over 4 percent; after 1981 the injection-recovery relationship was adjusted with very good results. This shows that for fissure-solution cavity type carbonate rock oil pools, the contradiction between recovery (and maintenance) of stratum pressure and controlling water bearing is very sharp, and will run through the entire oil field development process. To increase the results of developing this type of carbonate rock oil pool, it is necessary to regulate the contradiction between recovery (and maintenance) of stratus pressure and control of water bearing, and for this the following two important links should be given high priority and stressed:

(1) Controlling rational oil extraction rate and the corresponding rate of water injection. Less than a year after an oil pool went into production, due to the oil extraction rate exceeding 1.5 percent, water injection could not keep up, and output dropped 8.7 percent per month, stratum pressure dropped 11 atmospheres per month, and some wells even stopped; after September 1979 water injection was increased and produced results in the oil wells very quickly, since the rate of oil extraction had not been controlled, the volume of water injected was too great, and the period for waterless oil extraction in these oil pools quickly came to an end, the waterless recovery rate was only 1.8 percent; after 1981, adjustment of well was intensified controlling the oil extraction rate at about 1 percent, and at the same time peripheral water injection was intensified to control water injection in the top portion, retarding the rate of increase of water bearing and improving stable production.

(2) Using the water injection method to intensify peripheral portions and control the top portion. Before 1981, the water content of the oil pools of the Majiagou (Ordovician) system, in the Renqiu Oil Field increased rapidly, and in addition to the above factors, this was also due to oil injection wells being evenly distributed in the top portion of the oil pool, the water injected penetrated to the lower positions so that it speeded up the appearance of water and water bearing in the oil wells. Focusing on this situation, in early 1981 the water injection system was adjusted, and in

the peripheral portion water injection wells were added so that the volume of water injected rose to more than 60 percent of the volume of water injected; at the same time, the volume of injected water in the top portion was kept to less than 40 percent of the volume of water injected. After these measures were adopted, the rate of increase of water content in the oil pool per month dropped from the original 0.8 percent to 0.1 percent, and output per month diminished from 4.4 percent to 1.7 percent. The Ordovician oil pool in Longhuzhuang Oil Field is also a fissure-solution cavity type oil pool, and similar water injection methods were adopted here and also obtained good results. Practice shows that adopting water injection methods combining the peripheral and the top portions intensifying water injection in the peripheral portion fundamentally restoring and maintaining the stratum pressure, and controlling the water injection in the top layer to regulate the recovery rate of pressure, is an effective water injection method for fissure-solution cavity type carbonate rock oil pools. The physical basis for the effectiveness of this method is that it uses gravity to the best advantage. In the Majiagou oil pool in the Renqiu Oil Field, the oil bearing height is above 100 m, the stratus slope is over 30 degrees, which is favorable for taking advantage of the effective oil driving action of gravity.

## II. Pore-like Carbonate Rock Oil Pools

According to the rock core materials from Majian 4 Well, the lithic character of Gaoyuzhuang oil pools in the Hejian Oil Field is primarily of brecciated structure. According to preliminary statistics, the proportional thickness made up of approximately 85 percent light silicated brecciated yunyan [7189 1484], brecciated siliceous rock, and siliceous breccia yunyan, and about 15 percent of ni-fenjing [3136 4788 2533] yunyan and pelitic fenjing yunyan.

From test wells and core analysis materials it can be seen that the solution pore cavities in the gravel and solution fissures are the primary storage spaces. In the cores from Majian 4 well, the fissures are unusually well developed with fissure gaps mainly in the millimeter range, the fissures, cavities and pores are interconnected, showing honeycomb distribution, with a high degree of homogeneity; the large diameter rock core analysis average porosity is 14 percent, the small diameter rock core analysis average porosity is 12.5 percent.

The results of zhuti thin slice and electron microscope scanning show that the solution pore cavities are very highly developed, the throats are short and wide, and connections are very good. The solution pore cavities in the gravel is 60-100 microns, the gravel edge fissure cavities are about 20 microns wide, the intercrystal pores in the quartz and yunshi [7189 4258] filler and mastic material in the gravel are 5-10 microns, and throats are 2-3 microns wide. The expulsion pressure of the capillary pressure curve averages 2.1 atmospheres, the median saturation pressure averages 12.4 atmospheres, and the majority of the throats are larger than 1 micron. The mercury intrusion and reheat curves are similar to those of sandstone oil pools, the mercury withdrawal efficiency averages 54.3 percent.

The pore distribution map drawn on the basis of the rock core mercury intrusion materials from Majian 4 well has relatively log normal distribution characteristics, the proportional mass of throats with intervals of 0.24-7 microns is approximately 66 percent, which means that the pore throats are very uniform.

Unload dropout was not encountered in drilling most of the wells, which means that large fissures and cavities in these oil pools are not well developed but that small fissures and cavities predominate. After closing a well, pressure recovery speed is very slow, the slope is very large; effective penetration coefficient is 260 md, extraction index averages 16 tons/day-atmosphere, with production pressure difference generally greater than 15 atmospheres; these characteristics are very close to those of sandstone oil pools.

The results of laboratory experiments show that the relative oil-water penetration coefficient curve has the following characteristics:

- (1) The relative oil-water penetration coefficient changes with the degree of water saturation assuming a very steep "X" shape indicating the development of fine fissures and the solution pore cavities connecting them, forming primary vadose channels and reservoir spaces.
- (2) With the growth of water saturation, oil penetration coefficient drops sharply and water penetration coefficient rises rapidly indicating that the reservoir layer is very uniform, no delay appeared in the growth of the water penetration coefficient.
- (3) The interval of oil and water flow is very narrow and once water appears in an oil well water bearing rises very sharply. Thus in developing this type of oil pool, the waterless oil extraction period should be prolonged as much as possible to improve the waterless recovery rate.

Preliminary analysis shows that the displacement mechanism of pore-like carbonate rock oil pools is close to that of sandstone oil pools: the water driving process relies mainly on the action of drive pressure. Since the fine fissures and solution pore cavities are unusually well developed and very uniform, when production pressure difference is very great, one may implement a water driven oil process similar to piston type propulsion which can reach a very high oil driving efficiency. When the oil strata thickness is great or bottom portion oil injection is adopted, gravity can play a definite role and is advantageous for further improving the exploitation results.

In the more than 4 years that the Gaoyuzhuang oil pool in Hejian Oil Field has been exploited, basically without any major readjustment or technological measures, there have been over 3 years of stable production at an extraction rate of 7-8 percent, waterless extraction rate reached 22.2 percent, and recovery rate and water bearing rates implemented have both been 30 percent; however, since entering the water bearing oil extraction period, water bearing increased sharply and output dropped very quickly. Analysis holds that the primary factors are:

(1) The reservoir and shenliu conditions of the oil layer are good, oil and water viscosity ration is low, the water driving process is near piston type propulsion, oil driving efficiency is high; the existence of a compact stratum section at the botton of the oil pool is playing a definite obstructing role in water propulsion in the peripheral and bottom portions, leading to a delay in the time when water appears in the oil well and the uniformity of the rise in the oil-water interface.

(2) The peripheral and bottom water is very active and at the same time adopting water injection at a distance (more than 2 km from the oil pool) at an early period, maintaining a high level of pressure maintained high and stable production of the oil well's gushing. According to the calculations of the physical balance equation, the underground water is about 100-fold that of the oil and although it is a limited amount, the oil pool is rather small and the peripheral and bottom water can add to the energy in a very timely fashion and satisfy the demands of higher oil extraction rate, thus in the exploitation process peripheral and bottom water energy and be used very well. Water injection at Ma 19 well 2 km distant and at the bottom water area of the oil pool not only maintained a higher pressure level, but also promoted uniform propulsion of the oil-water interface. In fact, in the early stages of water injection, internal water injection experiments were carried out in the Ma 16 well on the periphery of the oil pool with the result that oil well production was stimulated, but traces of water bearing appeared and water injection had to be stopped.

(3) Long-term balanced production of the oil well was maintained. In the more than 4 years of exploitation of the Gaoyuzhuang oil pool of Hejian Oil Field, the rate of oil extraction and the oil well work system were relatively stable, the dynamic balance of volume of oil supplied by the well was maintained, and long-term balanced production was realized.

### III. Fissure-Cavity-Pore Combination Carbonate Rock Oil Pools

Reservoir layer research, laboratory experiments, numerical modeling, and oil field exploitation practice show that the fissures, cavities, and pores of the Wumishan oil pool in the Renqiu Oil Field are a highly developed compound type oil pool, and the numerous carbonate rock oil pools of the Jizhong district are also of this type. Very extensive research has been carried out on this type of oil pool in recent years and there have also been a great many results. Below we present a brief analysis of the displacement mechanisms and potential problems.

Because of the complexity of the depositional environment, the lithic character of the Wumishan oil pools in the Renqiu Oil Field is a rock type which is predominantly crypto dolomite and highly heterogeneous. Its reservoir spaces include the three major types: fissures, solution pore cavities, and pores. The fissures are predominantly structural fissures, characterized by being of many groups and systems (6-8 groups), of high density (generally 10-100 streaks/meter), and of a high degree of filling, but most have not yet been filled and form a major vadose channel. The solution pore cavities are highly developed. In the process of drilling wells, unloading of

the drilling rig occurred in 20 percent of the wells with empty spaces 0.17-2 meters in length; slush dropout appeared in 30 percent of the wells, with a dropout volume of 10-100 m<sup>3</sup>; the well diameter of approximately 40 percent of the wells was enlarged, with expanded diameter intervals of 0.5-5.6 meters. The pores generally are small solution filled holes and crystal holes which are secondary formations on the original foundation.

The variety of reservoir spaces leads to the diversity of reservoir and shenliu ability, not only having differences between storage layers and non storage layers, but also differences between good, medium, and poor storage layers.

In the pore distribution map made on the basis of the rock core analysis and simulation survey of the Shimian Mine in Jinzhou, Liaoning, there are characteristics of three peak transformations. The changes in closed well pressure recovery curve are very great: the initial test results of part of the well reflected a dual medium characteristic.

Summarizing the above, reservoir spaces of the compound fissure, cavity, and pore type in carbonate rock oil pools have triple pore characteristics. However, in terms of the unified outlook of reservoir and shenliu conditions, basically the storage spaces can be divided into two large systems of fissures and blocks. In this way, the dual medium can be simplified and recognized as a dual medium problem.

The fissure system is made up of fissures of 50-100 microns in width and the solution pore cavities that connect them, including the large fissure and large cavity reservoir and shenliu spaces made up of large and medium type fissures and the large and medium solution cavities connecting them. Storage layer research and laboratory experiment results show that the water driven oil process in this system relies mainly on driving pressure and gravitational action, at suitable injection extraction rates, water driving oil process approaches piston propulsion, water driven ultimate recovery rate may reach 70-80 percent. According to the results of numerical modelling, the geological reservoir is less than one-fifth the overall reservoir, but makes up over 60 percent of the extractable reserves, and over 80 percent of current output is produced from fissure systems. Test results of observation wells in the Wumishan oil pool in Renqiu Oil Field and results of testing oil by layers in wells with casing completed show that in the development process, rise of the fissure system oil-water interface assumes coniform propulsion overall, the law of oil and water distribution vertically is very clear, which means that the driven oil efficiency is very high. However, since the oil extraction rate has been too high over the past few years, the differences in the fissures had led to a wide gap in the rate and height of the rising oil-water interface, it is possible that below the current interface there are secondary fissure and cavity sections which has not been affected; in addition to this, the internal structure of buried hills is complex, high natural giema [8026 026A] argillaceous yunyan layer and a dense section of fissures which are not highly developed may in some regions play a relatively obstructional role and some unaffected peripheral and bottom water regions and discontinuous areas where changes in the oil-water interface appear. This shows that future development must further exploit potential.

Rock mass systems are aggregates cut by fissures, with poor reservoir and vadose conditions, and with complex distribution relationships, and include fine fissures and intercrystal pores and connecting small pore cavities and intercrystal and interparticle holes. Two laboratory experiments were conducted on rock mass systems: one is an experiment on self-absorption and removal of oil by capillary action; the other is an experiment on relative penetration of water driven oil and oil and water by degrees of external pressure. The results of the two experiments showed that both the oil self-absorption and removal process and the water driven oil process could only occur in the secondary pore portion connected by fine fissures, the rock mass system itself is very complex so using the concept of "aggregate" is very appropriate.

The results of laboratory experiments show that the wetness of Wumishan oil pools in the Renqui oil field is medium to weak hydrophilic, fault fissures were well developed, the stratum pressure is high, all of which are favorable conditions for oil self-absorption and removal. At the same time, since the wetness of the rock mass is weak, oil and water viscosity is proportionately high (20-30), the non reservoir thickness is proportionately large (about 40 percent), hole throats are proportionately high (100 to over 1,000), which has an impact on the breadth and depth of oil self-absorption and removal action, for these are not favorable conditions for it. The oil self-absorption and removal experiments generally were characterized by high speed and low efficiency (Table 3): half life was generally not more than a year, the time it took for oil self-absorption and removal was 2-3 years, the ultimate recovery rate was 16-26 percent, while for similar oil fields abroad it is generally 30-40 percent. The fact that oil bearing rock masses rely on capillary action for oil self-absorption and removal is one of the ways in which carbonate rock oil pools differ essentially from sandstone oil pools, and represent one type of displacement method. In the 7 years that the Renqiu Oil Field has been under development, because of the above-mentioned unfavorable conditions and the fact that oil extraction rate has been too high, the oil self-absorption and removal rate of the rock mass systems has been low and this may be because there are oil bearing rock masses which have not been affected, and must be further studied.

Table 3 Unit Rock Mass Self Oil Absorption and Removal Experiment Data

Well number	Rock sample	Porosity (%)	Air penetration rate (md)	Oil-water viscosity ratio	Bound water saturation (%)	Ultimate self absorption recovery rate (%)
Ren 28	1 $\frac{4}{8}$ (1)	3.23	0.06	6.70	90.6	
Ren 28	17 $\frac{8}{19}$ (2)	0.55	0.04	4.84	100	
Ren 28	29 $\frac{11}{14}$ (3)	1.93	1.48	4.84	72.6	26.0
Ren 28	40 $\frac{2}{11}$ (4)	4.33	0.80	4.84	17.3	16.8
Ren 28	43 $\frac{2}{7}$ (5)	2.07	>5000	4.84	0.7	
Ren 28	3 $\frac{9}{23}$ (6)	6.16	0.65	61.8	53.4	not measured

Experiments on relative penetration coefficient of oil and water show (Table 4) that with the action of external pressure by degrees, in oil bearing rock masses which highly developed fine fissures water driven process can take place and a much higher recovery rate of self absorption and removal oil can be achieved: waterless extraction rate of 5-49 percent, generally less than 17 percent; ultimate recovery rate of 10-81 percent, generally above 60 percent.

Table 4 Oil-Water Relative Penetration Coefficient Experiment Data

Rock core number	Porosity (%)	Air penetration rate (md)	Oil-water viscosity ratio	Bound water saturation (%)	Remnant oil saturation (%)	Waterless recovery rate (%)	Ultimate recovery rate (%)
Ren 28 3 $\frac{8}{25}$	6.27	0.51	5.7	29.1	24.2	16.8	65.5
61 $\frac{4}{10}$	7.13	78.4	5.9	28.8	21.2	48.9	71.5
Majian 1	3.20	17.8	22.2	36.8	26.9	3.7	57.4
4 $\frac{7}{9}$	2.20	11.6	37.5	33.4	59.8	5.0	10.3
4 $\frac{3}{9}$	11.7	10.7	5.5	36.7	24.3	12.4	61.6
Majian 4	21.7	1.80	4.83	42.8	10.2	42.8	80.7
4 $\frac{9+11}{11}$							
Ba 66							

On the basis of the above analysis, one can propose the idea of two displacement methods for rock mass systems: one is oil self-absorption and removal relying on capillary action, in which the basic conditions require a definite high degree of water saturation in the fissures system to be favorable for fluid replacement between the two systems; the second is oil driving by relying on external pressure by degrees, in which the basic condition is to eliminate the interference of the fissure system, especially the interference of large fissures and cavities, to be favorable for increasing production pressure difference. These are displacement systems with two completely different mechanisms and very different efficiencies. Under the actual conditions in oil field development today, production pressure difference is generally less than 10 atmospheres, driving pressure gradients are far less than the capillary pressure gradients, and the only the first

displacement method of oil self-absorption and removal can be used in oil-bearing rock masses; however, if the adoption of effective technology and techniques eliminate the interference of large fissures and cavities, increase the production pressure difference, then using the second displacement method of pressure driven oil may be practical. In oil field development, when entering the middle water bearing oil extraction period and the object of extraction gradually changes from fissure systems to rock mass systems, the idea of two types of displacement methods for rock mass systems we have presented has important significance.

Table 5 Results of Fissure-Pore Type Water-Driven Experiments

Type number	Water injection speed (ml/min)	Water-less recovery rate (%)	Water driven end time			Recovery rate		Notes
			Water-bearing rate (%)	Injection rate multiple	Recovery rate (%)	Injection twice pore volume	Injection 1.5 times pore volume	
10-3	1.5	13.28	99	0.96	48.37	48.37		water injection speed is average value
10-1	1.6	5.97	96	1.47	58.94	55.30	58.94	
10-2	2.5	12.27	99	1.47	54.01	52.81	54.01	
10-5	5.1	1.60	98	1.59	62.30	53.90	62.00	
10-4	7.0	1.27	99	2.82	57.00	44.40	49.80	
Type parameters	Gross volume 2050 cm <sup>3</sup> , fissure width 0.27 mm, fissure porosity 1.1 percent, rock mass pore volume 650 cm <sup>3</sup> , porosity 31.7 percent, bound water saturation 35 percent.							

Experiments on fissure and pore model water driven oil show (Table 5) that the ultimate water driven extraction rate is 50-60 percent, more than double that for the fissure and solution cavity model; the rate of water bearing rise is slower: the low water bearing period water bearing rate of rise is generally 1.5 percent, the middle water bearing period water bearing rate of rise is about 20 percent. This means that the effective development of this type of carbonate rock oil pool will be much better than that of fissure and solution cavity type oil pool. Development practice in the past 7 years in the Wumishan oil pool in Renqiu Oil Field shows that adopting peripheral and bottom water injection to maintain pressure, through gradually lowering the intensity of oil extraction in single wells, regulating the rate of water injection oil extraction on the basis of studying the reservoir layer characteristics and the displacement mechanisms, and carrying out technological attacks on key problems are important conditions for realizing stable oil

field production and improving development results. Ren 7 well high point was stable production for 6 years at a rate of 2.5-3 percent; present degree of extraction is 18 percent, overall water bearing is 11 percent, and development results are excellent.

#### Some Conclusions

(1) Carbonate rock oil pools currently under development in North China can be divided in a preliminary way into three storage types: fissure solution cavity, porelike, and fissure-cavity-pore combination.

(2) The pore distribution of fissure and solution cavity carbonate rock oil pools is characterized by single peak transformation, fissures and solution cavities are the primary reservoir and shenliu spaces, the rock mass basically does not have reservoir and shenliu capability; the water driven oil process of this type of oil pool relies mainly on driving pressure and gravitational action; developing this type of oil pool requires handling the contradiction of maintaining pressure and controlling water bearing to regulate the injection extraction relationship.

(3) The pore distribution of pore-like type carbonate rock oil pools is characterized by log normal distribution, the intergravel solution pores and cavities and solution fissures are the primary reservoir and shenliu spaces, the oil layer is highly uniform; the water driven process relies mainly on driving pressure, and under certain conditions gravity also plays a beneficial role; developing this type of oil pool requires prolonging as much as possible the waterless oil extraction period to improve the waterless extraction rate.

(4) The pore distribution of fissure-cavity-pore combination carbonate rock oil pools is characterized by multi-peak transformation, primary reservoir and shenliu spaces are fissures, solution cavities, and pores; from the uniform viewpoint of storage and shenliu, the triple mediums can be simplified and treated as dual mediums; under actual oil field development conditions, in fissure systems it is driving pressure and gravitational action oil driving, in rock mass systems it is oil self absorption and removal by capillary action; the key question in developing this type of oil pool is that it is necessary to rationally control the extraction rate and the corresponding water injection rate to improve the oil driving efficiency of both fissure and rock mass systems.

(5) For the dual medium carbonate rock oil pools, the rock mass system has two displacement methods which are completely different in terms of mechanism and differ greatly in efficiency: one is self absorption and removal of oil by capillary action; one is oil driving by driving pressure. When necessary, effective technical measures must be taken and implementing tertiary oil extraction methods are important paths to uncovering potential in the rock mass and improving development results.

In the process of writing this article, we referred to the materials and results of the work of Comrades Yu Jiaren [0151 1367 0088], Fan Zheren [2868

0772 0088], and Li Shuming [2621 3219 2494] of the North China Scientific Research Institute of Petroleum Exploration and Development, and here we would like to express our gratitude.

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CSO: 4013/228

## OIL AND GAS

### BRIEFS

1984 TOTAL CRUDE OUTPUT--The Ministry of Petroleum Industry has announced that as of today [11 December 1984] the nation had produced a grand total of 108,120,000 tons of crude oil, completing the state production plan 12 days ahead of schedule. This represents an 8 percent increase over 1983 and breaks the all-time output record set in 1979. Shengli, Liaohe, Jilin, Yumen, Jiangsu, Qinghai, Sichuan, and Yanchang all exceeded the year's production mission. Of these, the crude oil output of the Shengli and Liaohe fields was 24 percent higher than the same period in 1983. [Summary] [Beijing RENMIN RIBAO in Chinese 12 Dec 84 p 1]

HENAN OILFIELD PRODUCTION--The Henan Oilfield has continued a steady yield of crude oil and has gradually increased the output of crude year by year for 5 consecutive years. In 1984 it fulfilled the state quota for the production of 2.35 million tons of crude oil 5 days ahead of schedule. This was the highest level in the history of the oilfield. [Summary] [Zhengzhou Henan Provincial Service in Mandarin 1030 GMT 1 Jan 85 HK]

YINGGEHAI DEVELOPMENT STUDIED--The Western Petroleum Company of the South China Sea and Arco, China, Company Ltd. of the United States have achieved gratifying results since they began jointly prospecting for petroleum in the waters of the Yinggehai Basin last year. Up to now, drilling has been started at seven wells, of which five have been completed. Of these, two wells each produce 1.2 million cubic meters of natural gas per day. In July last year, they also drilled a well on the same geological structure which is producing some 1.8 million tons of natural gas per day, thus proving that this structure is a large gas field of commercial value. The Western Petroleum Company of the South China Sea and Arco of the U.S. are now working up a feasibility study on the exploitation and utilization of the gas field, and the fifth meeting of the joint management committee for the Sino-Arco petroleum contract at Yinggehai is being held. [Excerpt] [Guangzhou Guangdong Provincial Service in Mandarin 1000 GMT 13 Dec 84 HK]

CSO: 4013/73

## NUCLEAR POWER

### NUCLEAR POWER SOCIETY ESTABLISHED

Changdu HE DONGLI GONGCHENG [NUCLEAR POWER ENGINEERING] in Chinese Vol 5, No 4, Aug 84, Inside front cover

[Text] The Nuclear Power Society of the Chinese Nuclear Society was established in Beijing on 16 April 1984 and China's nuclear energy workers celebrated the event. The 52 representatives attending the establishment ceremony came from the Ministry of Nuclear Industry, the Ministry of Water Resources and Electric Power, the Ministries of Machine Building, and universities and colleges.

Comrade Jiang Shengjie [1203 5110 7132], Director of the Chinese Nuclear Society, spoke at the meeting and stressed the necessity of developing China's nuclear energy and the importance of establishing the Nuclear Power Society. He urged the Society to work with workers in other fields and contribute to the development of China's nuclear and power industry. Comrade Jiang also announced the appointment of the Director and Secretary of the Society.

Representatives to the meeting affirmed the policy of the Party Central Committee to develop hydropower and thermal power simultaneously to stimulate the development of nuclear energy and promote the growth of the power industry. Today's situation for nuclear power development is excellent, the Qinshan nuclear power station has begun construction and the Guangdong nuclear power station has also broken ground on 2 April. These are results of the correct policy of the State Council and the efforts of the associated departments. The meeting participants also made constructive suggestions for future work and for the establishment of specialty task groups. It is believed that the Society should study the policy for nuclear power development, investigate the technological development in nuclear power and make recommendations to the state. The Society should also publish the journal "Nuclear Power Engineering" to promote exchange with sister societies in China and strengthen international academic exchanges.

The establishment meeting was chaired by the standing Deputy Director Comrade Zeng, who reported on the preparation and organizing of the Society. Comrade Lu Guangji [0712 1684 5030], the Secretary, read the names of the Directors of the Society. The Standing Board of Directors held two meetings and discussed the establishment of five task groups (the secretary group, the academic group, the consulting group, the safety regulation group and the

journal editorial department) and 12 professional task groups including reactor physics, reactor thermodynamics and hydraulic and nuclear power safety. An editorial board was established for the journal "Nuclear Power Engineering". It was also decided that the first annual meeting will be held in the first half of 1985 to discuss the direction of nuclear power development, to explore the policy for China's nuclear power development and to invite the participation of sister societies.

9698

CSO: 4008/40

SUPPLEMENTAL SOURCES

FIVE-KILOWATT SOLAR POWER STATION BEING DEVELOPED

Guangzhou NANFANG RIBAO in Chinese 21 Nov 84 p 3

[Photograph and caption]



[Text] China's first prototype tracking and focusing 5-kilowatt solar power station is being operated experimentally at the Xiangtan Electrical Machinery Plant in Hunan. This prototype solar power station has been under development for more than a year by experts from the Xiangtan Electrical Machinery Plant and Space Electronics of the United States. The solar power station is ideal for use in deserts, grasslands, islands, and other areas where hydropower and thermal power are lacking.

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## SUPPLEMENTAL SOURCES

### NEW TECHNOLOGY BOOSTS BIOGAS PRODUCTION

OW180947 Beijing XINHUA in English 0703 GMT 18 Dec 84

[Text] Chengdu, 18 Dec (XINHUA)--Chinese biogas experts have developed a new fermentation technology which will boost production in low temperature regions, according to the Chengdu Biogas Research Institute.

Experiments in Sichuan, Hubei, Jiangsu, Guangxi, Hebei, Liaoning, and Heilongjiang Provinces show that the new technology enables an eight-cubic-meter biogas pit to generate 1.09 cubic meters of biogas every day in winter as against very little or no gas at all by using ordinary methods. The average annual gas generating capacity may reach 500 to 550 cubic meters, enough to provide fuel for lighting a home and cooking three meals a day for a family. Even in the sub-zero temperatures of Heilongjiang and Liaoning Provinces, daily gas generating capacity runs around 0.6 to 0.8 cubic meters.

The new technology was developed by the Chengdu Biogas Research Institute. To popularize the new methods, directions for mixing ingredients of different densities have been prepared for users.

The Chengdu Biogas Research Institute is a national center for developing biogas technology. Staffed by more than 90 scientists and technicians, the institute has developed a number of new technologies including the anaerobic fermentation technology. It has held courses for 62 trainees from 34 countries since it was set up in 1980.

China now has 60 biogas research institutes with a total staff of more than 300. Many colleges make the dissemination and utilization of biogas as an important subject of study.

The use of biogas in China's rural areas began in the 1970's. Up to the present, more than 4 million biogas pits are in operation in addition to a number of medium-sized and small biogas projects. It is used as fuel for processing farm produce and sideline products, drying grain, cultivating seeds, and killing grain worms. Two biogas power generating units have been installed on a trial basis. More than 500,000 biogas-generating pits are being built in China annually and rules and standards for their construction have been set up, according to the Ministry of Agriculture, Animal Husbandry and Fishery. It is estimated that 100 million rural people will be using biogas for cooking, lighting and other purposes by 1990.

## SUPPLEMENTAL SOURCES

### IDEA THAT FUEL FORESTS CAN SOLVE RURAL ENERGY PROBLEM DEBUNKED

Kunming JINGJI WENTI TANSUO [INQUIRY INTO ECONOMIC PROBLEMS] in Chinese  
No 8, 20 Aug 84 pp 30-33

[Article by Li Baihang [2621 4102 5300], Southwestern Forestry Planning Institute, Ministry of Forestry: "Doubts About the Policy Decision on Establishing Fuel Forest Bases"]

[Text] The capitalist world is facing an energy crises, prices for petroleum and other sources of energy are steadily rising, and energy resources are fast becoming exhausted. Faced with this grim reality, many countries are searching for new sources of energy that could be developed. The study of the development of forests as sources of energy has been launched precisely because of this situation. Since the forest as a source of energy is a natural and renewable resource, it only needs rational management to never become exhausted. Besides, there are many indirect benefits (ecological benefits) from forests, such as its regulatory influence on the climate, its retention of water, its preservation of water and soil, its beautification of the environment, and its cleansing influence on the air. It is for all these reasons that the study of the development of forests as sources of energy has especially attracted serious attention. In the last few years, it has been suggested abroad to establish "energy tree farms." These so-called "energy tree farms" are man-made forest bases created for the principal purpose of gaining a source of energy. The "energy tree farms" suggested abroad were meant principally to serve as new sources of energy for industry. The objective of these farms is different from that of our fuel forest bases, the principal purpose of which is to solve a problem in the livelihood of the people in our rural areas. However, there are also basic similarities between the two, namely the main objective of exploiting forests as sources of energy.

Ours is a socialist country; the superior socialist system enables the rational use of natural resources, so that we will never fall into the quagmire of an energy crisis. However, we must admit that energy resources still remain a weak link in our national economy. Precisely because this is so, the Party Central Committee and the State Council have made the development of energy resources one of the four key items of concern. The task of scientifically assessing the feasibility of developing forests as energy resources is therefore a responsibility that we, workers in the field of forestry, are duty-bound to assume.

## I. Forest Resources Cannot Be Man's Principal Energy Resource

The forest resource is a reproductive resource, but also a natural resource with its limitations. The development of forests is restricted by geographical and soil conditions; limitless development of forests is not possible.

Someone abroad has figured out precisely: the annual growth of the world's present forest resources is about  $3.4$  to  $6.8 \times 10^9$  cubic meters (annual growth rate calculated as 1 to 2 percent), converted to calorific value it becomes  $33.7 - 67.4 \times 10^8$  (10,000) megajoules (not counting energy losses during processing). If the total amount could be used as an energy source, it would only satisfy about 14 to 29 percent of the amount needed for the world's energy consumption.

How are conditions in China? Our 9.533 billion country has few forests; present forest reserves are 9.533 billion cubic meters, and the reforestation rate is 12 percent, placing China 120th place in a total of over 160 countries (and regions) of the world. Calculated according to the above-mentioned method, and turning all the timber grown in our country into energy resources, they could also satisfy only about 10 to 20 percent of the amount needed for China's energy consumption. That means that if one were to think of replacing all other energy sources by the forests as a sole source of energy, one would have to expanse the world's forest resources 4 to 6 times. It is out of the question that this can be accomplished within a short time. Moreover, if we use the entire growth of the forest resource as an energy source, it would not only be unrealistic, but also uneconomical. As the world's civilization progresses, mankind's need for wood and articles made of wood will not only not decline, but will rapidly grow. The possibility of using forest resources as a source of energy will in the future diminish more and more and become a total impossibility.

Of course, all our above computations are based on the present level of technology, and we did not consider the progress of science and technology. In the wake of scientific and technological developments, there is the possibility that man will find a method of raising the efficiency of plants to absorb solar energy, render the products per unit of fuel richer in energy, or have each unit of soil surface produce more biomass. However, up to now no one in the world has found a superior method of producing fuel biomass. On the other hand, if we want to expand the forest reserves 4 to 6 times, we would of course have to expand the forest land accordingly, and this could quite possibly aggravate the land-use conflict between forestry and industry and between forestry and agriculture and give rise to further restrictions on the future development of forestry. That is why we say that the forestry resource is a resource with limitations, a resource which mankind cannot use or develop limitlessly.

According to above calculations, we can conclude: use of the forest resources cannot completely solve the total energy needs of mankind. Figuring at the present levels of energy consumption and timber use, the forest resources can satisfy 5 to 10 percent of mankind's energy needs. That

means that the energy resource of the forest can only serve as a supplementary source of energy for mankind. We can predict that for a long time to come, forests cannot become a major source of energy for mankind.

## II. Adopting the Method of Fuel Forest Bases To Solve the Energy Problem in China's Rural Districts Is Unrealistic

Ours is a large country of 1 billion people, of whom about 80 percent live in the countryside. The energy supply and demand in the rural areas is therefore of a decisive influence on the policy governing our country's energy resource buildup. How, then, is the present condition of energy supply and demand in our rural areas? According to a report by Professor Yang Jike [2799 4764 3784], chairman, Special National Committee on Energy Resources in the Rural Areas (see GUANGMING RIBAO, 9 December 1982), and the data contained in the China Forestry Association's "Summary of an Academic Discussion of Forests as Energy Resource," we can summarize the present condition of energy resources in the rural areas more or less as: energy resources are seriously deficient, the composition of energy resources is but of one single type, and the methods of combustion are backward.

The serious deficiency of energy sources. According to the above, a considerable part of our 800 million peasants lack firewood for 90 to 150 days during the year. In areas with serious shortage, they are actually without firewood half the time every year. In Sichuan Province, for instance, there are actually 218 counties where villagers are without firewood for their daily needs for from 1 to 8 months; half of the peasants throughout the province are without firewood for an average of 4 months every year. In a certain locality in Guizhou Province, half of the peasants can cook only one meal a day due to the serious shortage of firewood; they were even driven to cutting down tea-oil trees for firewood for mere subsistence. Where there are no forests, the peasants dig up the vegetation that protects the soil and holds the sand and use it for firewood, thereby causing serious loss of soil due to erosion. Since there is this shortage of all energy even for daily use, how can there be any talk of developing rural industry? Without a solution to the rural energy problem, modernization of agriculture is nothing but idle talk.

The composition of energy resources is but of one type. According to statistical material on rural energy sources throughout the nation organized by districts, of the energy consumed in the rural areas of the entire country during 1977 68.3 percent was composed of biomass; in the energy used for livelihood requirements, the proportion was even higher (85.76 percent). That means that our rural areas rely for their sources of energy on the stalks of straw, firewood and charcoal (firewood and charcoal materials account for only about 13 percent). Coal and electric power make up only a very small proportion in the composition of the sources of energy consumed in the rural areas.

Combustion methods are backward. The peasants presently obtain heat mainly by the method of directly burning biomass. This is a most primitive and most backward method of combustion, where over 50 percent of the calorific

value is being lost. On the one hand there is this serious shortage of energy sources, while on the other fuel is wasted in large quantities. In Yunnan Province, for instance, it is estimated that 1,740 [sic] cubic meters of firewood are burnt annually, which amounts to 64.7 percent of the total consumption of forest material throughout the province, and this one item alone exceeds the 18 percent annual growth rate in the forests of Yunnan. If this is allowed to go on indefinitely, how can there still be talk of raising the rate of reforestation? It is impossible even to safeguard the forest resources that still exist. The forest resources of Yunnan Province amount to 980 million cubic meters (result of a 1979 survey). If the whole available quantity were used as fuel and burned up at the present rate, it would only last for about 100 years. The total quantity of firewood and charcoal used as fuel throughout the entire country is about 70 million cubic meters, which is over half of the annual growth of the country's forests and one-third of the annual consumption of forest resources throughout the country. Figured at 8 cubic meters per mu of standing forest, the burning of firewood alone destroys 8.75 million mu of forest annually throughout the country. These figures show that one of the major causes for the destruction of our forests is the backward method of cutting down trees for firewood. Without a solution for the needs of energy for daily use in the rural areas, there is no way to protect or develop forests.

Faced with the reality of serious shortages of energy in our rural areas, how are we to find a solution? As early as the 1950's, the Ministry of Forestry put forward the slogan of establishing fuel forest bases, but the anticipated results were not achieved. What was the reason? In my opinion the crucial point is that the personnel who has put forward the slogan, lacked any "figure-oriented" concepts when it comes to the quantitative needs of energy sources in the rural areas of our country. They had no idea how many fuel forests it would take to satisfy the needs of energy for the livelihood of the rural population. Besides, the reason why this slogan could not be put into practice is that it runs counter to objective economic laws.

First of all, let us calculate: how many fuel forests would it require throughout the whole country to satisfy the needs of energy for the livelihood of the rural population? According to the actual survey data for the rural areas of Yunnan Province, every peasant household requires annually about 3.4 cubic meters of firewood. According to the growth rate of southern fast and abundantly growing trees (eucalyptus), the said requirement could only be satisfied by a 6-year growth of 6 mu manmade forest. If we want to satisfy the energy needs of the whole rural area throughout the country, the whole country must plant 960 million mu of fuel forest. It is estimated that the whole country has about 1.2 billion mu of barren hills and uncultivated land suitable for tree-growing. That means, to completely solve the energy problem for the people's livelihood in the rural areas, fuel forests must be created on most of the barren hills and uncultivated land suitable for tree-growing throughout the country. This is completely unrealistic. Besides, even if fuel forests could be created on all the barren hills and uncultivated land suitable for tree-growing, and the trees

were already there, it is still not certain that this would solve the problem of energy needs for the livelihood of the rural population, because we know that the areas most in need of fuel are the plains, where all land is under cultivation and where it would be impossible to grow forests. The barren hills and uncultivated land suitable for tree-growing are all in the mountainous border regions far away from the plains. After the trees have grown in the forests, the peasants who lack firewood would not be able to get it (if one were to rely on transportation, the poverty-stricken peasants, we are afraid, would not be able to pay the freight). That means that, apart from doing our calculations, we also have to be aware of the distances between the afforestation and the places where the peasants are who need the firewood. Otherwise, we will find the peasants unwilling to grow forests, and even if they had grown the trees, they would be unable to obtain any benefits from them. The actual conditions are always: in the areas where there is a shortage of firewood, there is almost no land to grow forests; in areas suitable for tree-growing, there is usually still firewood available, and the peasants do not feel an urgency and show little enthusiasm for the creation of fuel forests. This may also be one of the reasons why the creation of fuel forests remained unsuccessful for such a long period of time.

Second, afforestation takes a long time and actual benefits cannot be expected the same year; this is no solution for a situation of extreme urgency.

Third, most importantly, the economic results from growing fuel forests are unsatisfactory. Taking the growing of man-made forests of eucalyptus trees as an example, according to this writer's investigations at the Leizhou Forest Bureau of Guangdong Province, the standing stock of 1 mu of eucalyptus trees grown in 6 years is about 3 cubic meters, i.e., the average annual growth amounts to 0.5 cubic meters. If all is used as firewood, and figuring at 10 yuan per 100 kilos, the quantity of wood as building material (or as mine props), the gross income would be about 100 yuan, while used for shaved board or as paper raw material it would bring 2 to 3 times more than if used as fuel. The above shows the results in the use of only one kind of tree, actual conditions may even be more complex. If the conditions of geography and soil permit, people could turn to growing more profitable types of trees (such as fruit trees, woody oil-bearing or woody foodgrain crops, etc.) and in this way the economic results would be much higher. For instance, in Greece, which is a country with extremely dry hills and not very good soil, the peasants are very well off because olive trees are grown over that if forestry is to be developed. we must not merely stop at propagating "planting trees to make forests," but must, according to the actual conditions, show the peasants the actual way to prosperity by growing trees.

If we do not plant fuel forests and use as fuel the leftover materials from timbering and processing material that is not being used now, it could at best solve only 10 percent of the energy needs of the rural population, which is far from satisfying the total demand.

In consideration of the above reasons, it is my opinion that the idea of trying to solve the energy needs of the rural population of China by growing fuel forests is not consistent with reality; it is a policy decision that lacks economic concepts; one may even say it is a blunder that exploits our efforts to build up the energy resources of our country. Not only do I oppose the creation of fuel forests, but I also believe that we must eliminate as quickly as possible the backward methods of directly burning biomass.

### III. A Solution to the Problem of Energy Sources for China's Rural Areas

According to the above analysis of the situation, the basic policy in the question of providing energy sources for our rural areas must be: opening up new sources of energy, establishing a varied structural system of energy sources, reforming the methods of combustion and raising thermal efficiency. Moreover, we must also be aware of the fact that although income among vast numbers of our peasants has greatly increased since the 3d Plenum of the 11th CPC Central Committee, the peasants in the mountainous areas are very poor. Every development of whatever energy source must be carried out on the principle of small investments and quick results. Because of the low educational level in our rural areas, we must at the same time promote the use of simple and convenient sources of energy. Repeated comparisons carried out by this writer as to coal, electricity, solar energy, and methane have convinced me that methane is presently most appropriate for use in the rural areas.

Methane is also a reproductive energy source. Using methane as fuel basically overcomes the various drawbacks of directly burning biomass, raises thermal efficiency, and improves hygienic conditions. The promotion of methane has a history of over 20 years in our country, the technique is well mastered and much experience has been acquired; this has already become known worldwide. However, as a result of the great hubbub about methane at the time of the "great leap forward," there are still some people who shake their heads at the mention of methane. In my opinion that is not justified. Now is the time to restore the true picture of what methane really is! It is gratifying that through its long and tortuous history, methane has indeed regained the confidence of the people and a new "methane enthusiasm" is sweeping the country. Looking at the example of Yunan Province: up to the end of 1983, over 3,100 methane-generating pits have been built throughout the province, of which 92 percent are still in regular use. In the suburban districts of Kunming up to the end of the first half of 1983, 3,539 methane-generating pits had been built, 52 communes have started experiments with methane, comprising 86.6 percent of the 60 communes in the suburban districts; there are in addition 35 production brigades (villages) that are turning to methane production. Many people have become aware of the benefits of methane operations and are asking for methane installations. Yunan Province, therefore, plans to build 50,000-70,000 methane-generating pits during the period of the Sixth 5-Year Plan and to raise that figure to 200,000-300,000 during the period of the Seventh 5-Year Plan. We believe that methane is a new source of energy with great potential and must be studied and promoted most energetically.

Compared with firewood and charcoal, hydroelectric power and solar energy, methane has the following advantages: 1. It occupies little or almost no space. Qiaojia County in Yunnan Province constructed one type of methane-generating pit that combines toilet, manure storage and methane container. It is convenient to operate and also saves space as compared to the building of a separate methane-generating pit. 2. It requires little investment and yields fast results. According to statistical material at the methane office of Yunnan Province, the cost of one methane-generating pit is about 150-200 yuan, and it is operative 1 month after construction. 3. The technology involved is simple and it is easily managed. Peasants can master the technique after a short training, not as in the case of hydroelectric power which requires specialized technical staff to develop. 4. It saves raw materials and yields high economic results. Calculating at the present level of technology, one household of 5 or 6 heads uses 1.0-1.2 cubic meters of methane as production fuel, which is 360-400 cubic meters a year. To produce this quantity of methane requires only 1,000 kilos of straw stalks and 4,500 kilos of feces and urine. If straw stalks were burnt directly, 10 kilos would be required per day, or 3,600 kilos between the two methods, which means a difference of somewhat over 70 yuan. The saving of this item of raw material alone can offset the investment in the methane-generating pit in 2 to 3 years. Moreover, after fermenting, the biomass is an excellent organic fertilizer. According to estimates, one methane-generating pit can produce in 1 year organic fertilizer to the value of about 50-60 yuan of chemical fertilizer. 5. It overcomes the drawbacks of directly burning biomass, raises thermal efficiency, is clean and hygienic and causes little pollution. 6. Development of methane is an important means of protecting and developing forestry. Precisely for this reason, the development of methane must not be left an affair of energy departments alone, but should also be actively supported by the departments of the Ministry of Forestry, who should take the promotion of methane firmly in hand as an important measure of developing forestry.

Of course, methane also has its limitations. When the temperature is close to zero degrees, it is not possible to generate methane. It is therefore still difficult to develop methane use at high elevations with cold temperatures. Even in Yunnan Province, methane can only be used for an average of 9 to 11 months per year. In the northern regions of our country, the time when methane can be used is short. It is then necessary to use other energy sources as supplements. China is a country with a vast territory and a huge population; it would be unrealistic to try to solve the problem of the whole country with the use of only one kind of energy source. Even in the areas where methane can be used, it is necessary to consider the simultaneous development of other sources of energy and to gradually establish a system of several energy sources with one type as the primary source of energy.

9808

CSO: 4006/141

## CONSERVATION

### BRIEFS

HUBEI ENERGY CONSERVATION--By the end of this year, the industrial front in Hubei Province had conserved energy amounting to some 1 million tons of standard coal. The industrial front overfulfilled the state quota for energy conservation by over 100 percent. From January to November, the province saved 999,700 tons of coking coal. In 36 key enterprises, including the Wuhan iron and steel corporation and the Huaxi Cement plant, the annual consumption of standard coal of each of which is over 50,000 tons, the energy consumption this year for each 10,000 yuan of output value was 19.9 tons of standard coal, and was 6.1 percent less than in the same period last year. [Summary]  
Wuhan Hubei Provincial Service in Mandarin 1100 GMT 30 Dec 84 HK]

CSO: 4013/66

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